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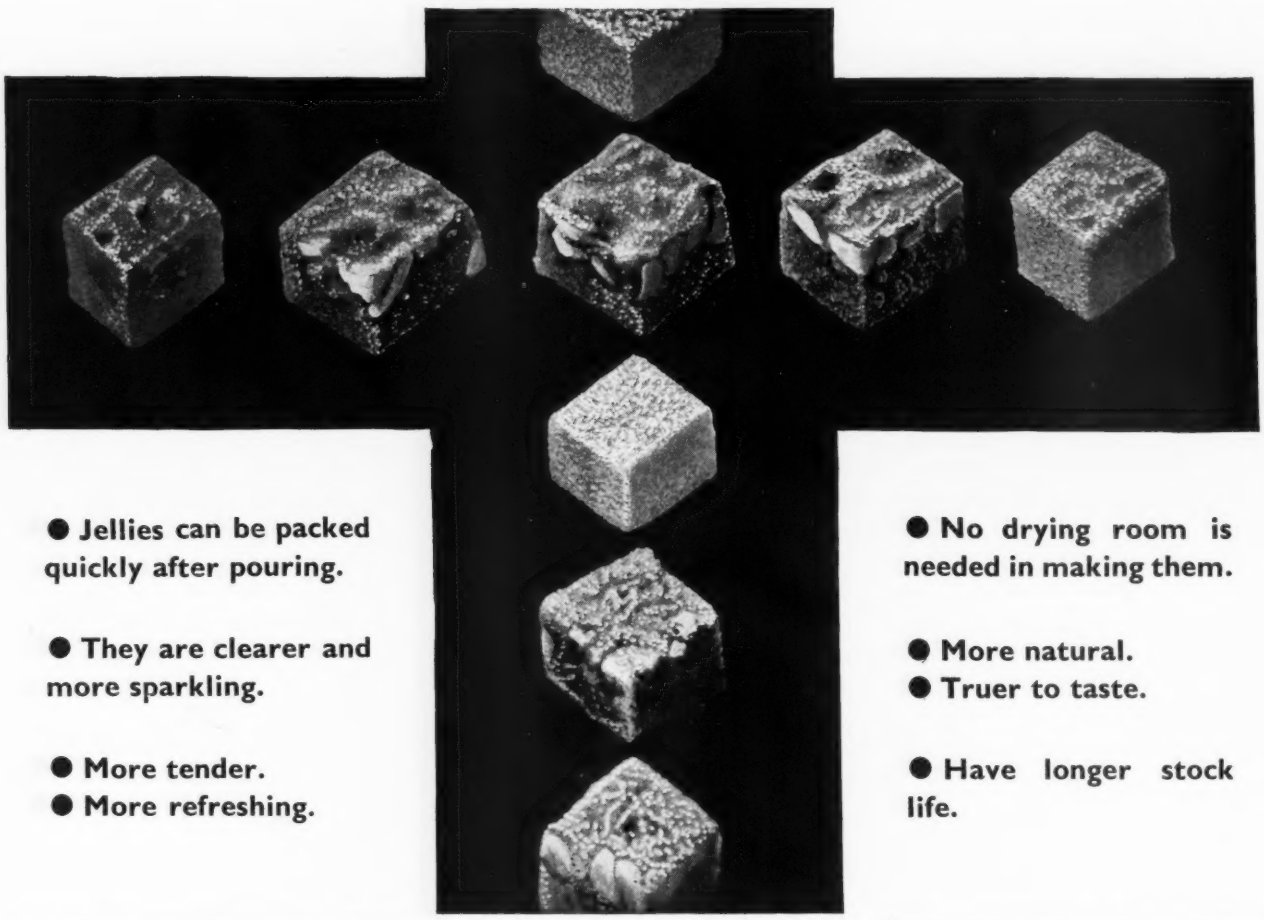

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A JOURNAL DEVOTED TO THE PRODUCTION AND MANUFACTURE OF: Chocolate, Confectionery, Biscuits, Bread, Cake; Jam; Glacé, Candied and Preserved Fruits; Fruit Juices and Cordials; Jellies, Honey and Lemon Curd; Cheese and Milk Products, Infant, Breakfast and Invalid Foods; Ice Cream; Canned Foods; Meat, Fish and Vegetable Products; Soups, Pickles, Sauces, Pastes and Extracts, and all edible commodities involving a process of manufacture.

FOOD MANUFACTURE

Incorporating Canning, Packing and Preserving.

Volume . . . X
Number . . . 5

MAY . . . 1935

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FOOD MANUFACTURE

Vol. X, No. 5 May, 1935

"The Indian and Eastern Druggist"

OUR READERS will be interested to hear that Messrs. Leonard Hill Limited have taken over *The Indian and Eastern Druggist*, the first issue of which in its new form has just appeared.

The Indian and Eastern Druggist is the only trade journal linking the manufacturer with the export druggist trade to the East. It goes without saying that under the new proprietorship it will rapidly attain the high standard characteristic of the Leonard Hill publications, and will be greatly extended in scope and vastly improved in reader interest and presentation, thereby rendering valuable service to the trade.

Feed Your Dog

The science of dietetics is spreading from man to man's greatest friend, his dog. We are being educated in the art of balanced rations for our own amelioration, and the man in the street has now a working knowledge, at any rate, of the parts played by vitamins, carbohydrates, and fats in his daily food, and realises that calories have other significancies than their relation to the monthly gas bill. Having barely grasped the rudiments of this new scientific form of feeding, man is essaying the time-honoured experiment of " trying it on the dog." We have recently read with very great interest a booklet published by an American vet. —E. C. Goodrich, D.V.M.—called *Scientific Dog Feeding*, and feel sure that every dog lover would also derive great pleasure from its perusal, even though all its suggestions were not put into practice.

The food for a dog is obviously as important to him as is the diet of his owner to himself, but, unfortunately, the dog has no say in the matter and must taken what is given to him or leave it. This booklet, based on much experience, deals with such elementary, but little appreciated, subjects as undesirable and desirable foods, and gives the amounts of meat, cereals and vegetables that are suitable for different types of dogs. After a general discussion of the various fundamentals such as vitamins, mechanism of digestion, digestibility of different foods, commercial dog foods and various symptomatic indications, the book, with characteristic American thoroughness, gives lists of varied diets for seven successive days. To quote only one day: for breakfast the non-sporting dog, such as the chow or the bulldog, gets raw eggs and milk over cream of wheat or cornflakes, and for dinner granulated dog food with mashed peas, spinach, and bonemeal. If the suggestions laid down in this book are carried out a dog's life won't be such a bad one after all! The book might be studied by manufacturers of dog foods, and dog owners themselves, with profit as well as amusement.

Respiration of Fruits

A recent issue of *Nature* summarises a Friday evening discourse given by Dr. Franklin Kidd, Director of the Low Temperature Research Station, Cambridge, to the Royal Institution on the respiration of fruits.

Dr. Kidd discussed in detail the mechanism of respiration, the changes in respiratory activity, the chemistry of respiration, the storage of fruits, and the various stages of respiration.

One has only to read this account to realise the exceedingly complex nature of the changes experienced by the various constituents and emanations of, for instance, the apple. Dr. Kidd traced these variations in the case of fructose, glucose, sucrose, acids, starch, proteins, carbon dioxide, ethylene, acetaldehyde, flavour, colour, and so forth. He recognised five morphological and physiological stages in the life-history of the apple, and he discussed the various means for controlling the span and speed of life in fruits.

If anyone doubts the application of physical chemistry to biological problems, let him read this paper!

pH Changes in Fruit

Another paper of similar nature is from the pen of J. S. Caldwell, and concerns the "Hydrion Concentration Changes in Relation to Growth and Ripening in Fruits" (*Tech. Bull. No.* 403, *U.S. Dept. Agr.*, February, 1934).

Comparative studies have been made of the relations between changes in active acidity, on the one hand, and changes in volume or weight and in chemical composition, on the other hand, in a number of fruits of widely diverse character. This work forms part of an investigation of methods of preserving fruits now in progress at the Bureau of Plant Industry, which necessarily involves a study of the chemical and physicochemical methods of determining the stages of maturity of the fruit, since the latter largely determines the quality of the preserved product. The *p*H of the juice has been studied in order to see if this affords a criterion of the stage of maturity.

Pectin Extraction

The research workers at the Delaware University continue their investigations into pectin gels. Recognising that the common methods of extraction do not fully take into account the variation in the actual quality and quantity of available pectin present in raw material, G. L. Baker and R. F. Kneeland have recently (*Fruit Prods. Jour.*, March, 1935) described a method for rapidly determining an index to the effective pectin yield (jelly units). By this method any increased yield caused by variation in time, temperature, or *p*H can be detected. By varying the standard procedure the optimum point of extraction is found, which assures a lower cost of production per jelly unit.

Essentially the method consists of a check on the jellying quality of a pectic extraction by the use of a viscosity measurement. Viscosity has been found by Myers, Baker, and Wilson to be an index of pectin quality when measurements were made on pectin extracted in a similar manner from a similar source. Baker has also used viscosity as an indication of the quality and quantity of pectin in a fruit juice extraction. He now uses viscosity as a measure of the quantity of jelly units present in a pectic extraction.

Maleic Acid

This interesting acid looks like coming more than ever into the limelight judging by a letter from Mr. Copisarow to the *Jour. Soc. Ind. Chem.* of March 29. We have previously commented on Greenbank's patent taken out under the auspices of the U.S.A. Government for the use of maleic acid as an antioxidant in suppressing peroxide formation and hence in inhibiting fat rancidity. It will be recalled that Greenbank and Holm (*Ind. Eng. Chem.*, March, 1934) have shown that as its solubility in fats and oils is of the order of only 0·01 per cent., excess of the acid may be used and then removed by filtration. It is stated to add no taste, odour, or colour to the product and may be used in connection also with materials such as milk powder, pastry, and caramels. Copisarow states that it is non-toxic, although upon this question it would be both interesting and instructive to have some definite ruling from the Ministry of Health.

Fruit Preservation

But the point about Copisarow's communication is that the claim is made that solutions and suspensions of maleic acid in ethereal oils (lemon and orange oil, ethyl and amyl acetate, iso-amyl valerate) inhibit the sprouting of potatoes and the maturing of apples. Moreover, the keeping properties of ripe fruit were found to be considerably enhanced by spraying with maleic acid, the medium of which was adapted to the flavour of the particular fruit, mould being eliminated and decay greatly reduced. It is significant to note that satisfactory results were not obtained with an aqueous solution of maleic acid, nor with fumaric acid.

The Mechanism

Mr. Copisarow puts forward some interesting speculations as to the mechanism of these peculiar phenomena. He points out that maleic acid is not only constitutionally related, but is in fact a link in a chain of partly reversible reactions, involving a group of naturally occurring di- and tri-carboxylic saturated and unsaturated acids. It is conceivable, therefore, that maleic acid is actually produced during the metabolism of apples and is intimately connected, if not identical, with the germination-inhibiting substance.

He also makes another very interesting suggestion; the ethylene evolved (which accelerates ripening) during the maturity to senescence period of the apple metabolism may result from the degradation of maleic acid under the influence of modified enzymic activity.

The ripening function of ethylene, it is suggested, is due to its specific action on amylase and the consequent conversion of the starch granules into reducing sugars, attended by fruit-softening,

colour-changes, etc., ultimately leading to a greater vulnerability to parasitic attacks.

Yet another interesting point. Assuming an apple produces 1 c.c. (or 0·00126 gm.) of ethylene, this corresponds to 0·005 gm. of maleic acid, which represents a concentration of 0·02 per cent. in an average, 100-gm. apple. This concentration compares favourably with the tested potency of maleic acid (0·01 per cent.) as an inhibitor of rancidity in fats and oils.

Pigs for Bacon

Pig breeders and bacon manufacturers met in conference at Rothamsted on March 6 to discuss the question of producing pigs for bacon. Mr. J. B. Busby's paper was entitled " What the Bacon Factory wants and how the Danes secure it." He said that the factory wants a steady and adequate supply of pigs of correct bacon type—namely, good length animals with proper proportion of lean meat, light in the shoulder, and as uniform as possible in carcase weight. The Danes have secured this by great care in breeding and selection on the basis of carcase records, and by technical education and attention to detail. To obtain the necessary lean meat, young pigs are never allowed to lose their baby flesh, and rations containing a high proportion of protein are fed.

Suggesting lines of improvement, Mr. Busby said that we must set out to lighten shoulder without losing stamina. The present belly measurements might be abandoned and replaced by three back-fat measurements as used in Denmark.

Maté

Some years ago on one of the Hamburg-American liners we made our first acquaintance with the beverage maté. This is replacing tea and coffee in many places, particularly South America and associated countries. Maté consists of the dried leaves of various species of Ilex shrubs indigenous to Brazil and Argentina. It is usual to take the drink as an aqueous infusion prepared in a silver cup or gourd—hence the name maté. In view of its spread to Europe in recent years, the work of Woodard and Cowland on " The Question of Tannin in Maté ", published in the last issue of the *Analyst*, is of considerable interest. Apparently the process for curing maté is distinct from that used for common tea, and it is unlikely to produce any appreciable change in the phenolic constituents of the plant. Several chemists have reported the presence of tannin in maté, either identical with, or analogous to, that in tea. Woodard and Cowland have proved that there is little similarity between maté and tea, and that while tea undoubtedly contains genuine tannin, maté does not, since there is no phlobaphen present, no gallic acid, and, moreover, the modern process by which the leaf is cured is unlikely to produce tannin or destroy it. There are differences and similarities between maté and coffee, one chemical similarity being in the beautiful emerald green colour given by extracts on addition of ammonia.

Digestion Pictures

In a recent issue of *The Lancet*, Maile and Scott have described some very interesting work on the determination of the digestibility of common foodstuffs by radiography. X-ray screening methods were applied, one ounce of " barium " mixed either with the food or with a little water, which was taken with the food, being used. It was found that an ordinary meal leaves the stomach in about four hours, but a large meal takes five hours. If the meal contains much fat (especially as butter or cream) it may be retained much longer, even if the quantity is not unduly large. Concentrated carbohydrates (*e.g.*, sugar) leave the stomach more rapidly than natural carbohydrates (banana or potato, etc.). With some foods, cooking shortens the time of stomach digestion, as is the case with milk, but in others, such as eggs, the time is lengthened. The period of stomach digestion of different foods cannot be taken as a measure of their " digestibility ", and since the sensation of hunger does not necessarily result from an empty stomach there is no support for the view that it is due to vigorous peristaltic contractions of the stomach. The figures obtained in this study indicate a longer emptying rate than " digestibility " tables based on tube experiments. This may be explained by the fact that the barium delays the emptying of the stomach or, on the other hand, that the Rehfuss tube acts as an irritant and causes exaggerated peristalsis.

Future of Marketing Schemes

The recent statement on our Agricultural Policy by the Scottish Chamber of Agriculture provides at last a common sense suggestion for the benefit of producers and consumers alike. The time has surely arrived for clear thinking on this subject, and outright speaking is necessary. The Scottish Chamber has shown the Government the way, and there is nothing uncertain about the proposals made. The Government have repeatedly stated

that their agricultural policy has been experimental —doubtless necessary in the complicated state of British Agriculture. Every wise experimenter, however, takes stock of his position periodically and realises that there must be a time limit to all experiments. Not even the most ardent supporters of the Government can truthfully assert that the marketing schemes have been a success. The quantitative control of imports which has accompanied some of the schemes has benefited the foreign producer more than the home farmer at the expense of the consumer. All along the line—bacon, pigs, milk, hops — dissatisfaction has followed in the wake of the marketing schemes. Even prominent members of the Government are now stating that tariffs would be better than import quotas. We have had several years of fruitless experiment; it is now high time that the Government should do something really practical for home farmers and consumers.

Milk Experiments

The Government have now decided to carry out experiments on school children with a view to determining whether milk is of any value as a food and also if pasteurised is better than raw milk. The Government are really good at putting the cart before the horse. Some months ago they decided to get rid of some of the milk they could not sell by giving it to school children—presumably, as we thought then, for the good of their health. Now, however, they do not seem to be quite so sure, and have organised a big experiment. It is proposed to feed different amounts of raw or pasteurised milk to children in elementary schools. About 2,000 children are to receive no milk, 2,000 are to have $\frac{1}{3}$-pint pasteurised milk, 2,000 will have $\frac{2}{3}$-pint pasteurised milk, and 2,000 will have the same amount of raw milk. The children who get no milk will be given biscuits—goodness knows why! It is difficult to see what real information will be gained from this absurd experiment. How are the extra school factors to be evaluated? Are the people responsible for the experiment proposing to find out the exact diet of the children at home? Obviously the physical condition of the children at the beginning of the experiment and the food, clothing, rest, and recreation provided at home will have much to do with the condition of the children at the end of the test. It is doubtful whether the milk will show any noticeable effects at all. Four full-time medical officers have been appointed to conduct the investigation, and doubtless they will want secretaries and assistants; so that, apart from the cost of the milk, more public money is to be wasted on a most doubtful experiment.

Proteolytic Activity

In the March issue we referred to the growing use of the farinograph in flour testing. So far it has been mainly applied to the investigation of gluten strength. Recently Quick Landis, of the Fleishman Laboratories, New York, has applied the instrument to obtain an index of the proteolytic activity of flour. There are many difficulties in the way of such an investigation, and results may be obtained leading to completely erroneous conclusions. Thus it is essential that a standard substrate should be prepared. The incorporation of added ingredients at the beginning of mixing introduces considerable variations in the type of mixing received and in the consistency at the end of mixing. It is essential to obtain a standard dough before the addition of the enzyme. Landis appears to have got over this difficulty, and he has come to the conclusion that by using an easily replicable dough of uniform consistency as a standard substrate the determination of proteolytic activity by this method is possible. He defines the development energy (D.E.) of the dough as that energy, expressed as the product of degrees Brabender by the time (B × minutes) required to develop the standard test dough to its maximum consistency. The rate of decrease of D.E. is proportional to the time and to the concentration of proteolyst. One proteolytic enzyme unit has been defined as that amount of enzyme which, when present in the standard dough, will produce an initial rate of increase of D.E. of 1,000° B – minutes per hour. The degree of proteolytic activity is taken as the number of enzyme units per gram of material. The work is still embryonic, but it does seem that real progress is being made in a most complex field of cereal chemistry.

Action of Rennet on Milk

Among the series of papers presented at the Tenth World's Dairy Congress, held twelve months ago in Italy, which have now been translated into English and published as a series of volumes, one by Dr. F. Springer of Vienna on the influence of the nature of the container on the time of coagulation of the milk by rennet is of special interest. Remarkable variations were found according to the material—*e.g.*, wood, enamel, metals—used in the construction of the vessel in which coagulation was carried out.

THE MANUFACTURE OF JAM

By R. S. POTTER, B.Sc., A.I.C.

AS WITH all commercial food products, the essential feature of jam production is uniformity. It is not difficult even for an amateur to make a boiling of jam which might be considered perfect from every point of view, but it is another matter to reproduce the same result regularly under factory conditions. The difficulty in obtaining uniformity is particularly evident in jam making, unless great care is taken, on account of the very wide variations of the fruit. The jam manufacturer has to contend with seasonable variations, variations due to storage changes, conditions of cultivation and harvesting of the fruit, to mention only a few points. Analysis of the ingredients, even if possible, does not always give sufficient information to enable a perfect jam to be made at the first trial, and it is for this reason that the expert jam boiler is still in demand in the industry. Jam production is becoming more and more of a science, but the art still lingers.

Raw Materials

Of prime importance are the materials to be used, and here it must be said that experience in choosing and blending fruit is almost indispensable. The manufacturer has a choice of four classes of fruit:

1. Fresh fruit.
2. Frozen fruit, or chilled fruit.
3. Canned fruit, or fruit pulp.
4. Fruit preserved by sulphur dioxide.

The above are probably placed in their order of merit as regards their suitability for jam making, and while fresh fruit almost certainly produces the best jam, fruit preserved in sulphur dioxide (SO_2) is probably the most convenient for handling in the factory. For this reason, and of course on account of the fact that large stocks of fruit may be preserved in this way for out-of-season work, jams made from sulphited pulps have occupied a very important place in the industry for many years now.

It would be difficult to deal with the subject of jam fruit collectively under one heading, and therefore a few of the more popular fruits will be dealt with individually. Before doing so, however, some general remarks which apply to all varieties will save repetition under the subheadings. Good, sound fruit should always be used, whether fresh fruit or pulp is chosen, and it should be thoroughly sorted into trays before use. If fresh fruit has, unavoidably, to be kept overnight or longer, it is always advisable to cover with water and to add a small quantity of preservative (sulphurous acid or other sulphites). This will prevent the development of yeasts and moulds which might cause trouble later; about one pint of 6 per cent. acid per cwt. of fruit will be sufficient. If sulphited pulps are being employed, each cask should be examined for signs of fermentation before use, by removing the head. Usually any fermentation is evident at once either by signs of gassing or by the return of some of the natural colour of the fruit due to the preservative having been lost by evaporation. Casks of fruit pulp should be stored in a cool place out of the sun and rain, and only brought into the factory as required. It is a wise precaution to test the amount of SO_2 present periodically, and to add a further amount if required. If frozen fruit is being used, this should be allowed to thaw out naturally, and it should then be used soon after.

Strawberries

A wide range of strawberries is available for jam making, but owing to the lack of sufficient quantities of those which are really suitable varieties, a large tonnage

(Courtesy Broome and Greene.)

Strawberries bedded down.

of pulp is imported, the chief sources being Holland and Russia. The bulk of these arrive in the country preserved in SO_2 in casks, and a smaller amount canned.

Among the best varieties of English strawberries for jam making are probably Sterling Castle, Ruskin, and Royal Sovereign, while Paxtons are quite often used. Strawberries intended for jam should always be firm and free from plugs and stalks; also the fruit should be watched for any blemishes such as hard black patches, which are particularly liable to be present on Paxtons. If jam fruit is a by-product of the cannery, it should always be re-sorted before being made into jam, or before preserving with SO_2; all large and irregularly shaped berries, such as are often found with Oberschlesien and Madame Kooi, should be removed. If the fruit is a little on the soft side it may be firmed up by standing overnight in water to which a little bisulphite of lime has been added.

It is a good plan always to blend varieties of strawberries when making jam, as, by this means, seasonal and other variations may be compensated for to a certain extent. For example, a boiling may be made up of equal proportions of, say, Paxtons, Ruskins, and Dutch fruit. In this way greater uniformity of the finished jam is attained than if each variety were used up separately.

Raspberries

Most of the usual canning varieties, such as Pynes Royal, Lloyd George, or Norfolk Giant, are well suited to jam making, but the use of those fruits which show an excessive number of seeds should be avoided. When making raspberry jam it is a good plan to use a certain proportion of Scotch fruit, as the seeds of the latter retain their fresh appearance for a longer time than most English fruit. If all English fruit is used the jam may assume a dead appearance after lengthy storage.

Raspberries intended for jam should always be sieved before use through a fairly fine-mesh sieve; this will remove plugs, stalks, and any hard berries.

Blackcurrants

Again most canning varieties, such as Baldwin, are suitable. The main difficulty with blackcurrants, and more particularly with sulphited pulp, is a toughening of the skins, which is likely to occur during boiling. For this reason the fruit should not be too mature nor too under-ripe; otherwise not only will the jam contain tough skins, but excessive floating of the fruit to the top of the jar will probably result. In order to avoid this trouble it is important to see that the fruit, or pulp, is boiled until it is tender before the sugar is added.

Plums

Probably the best plum jam is made from the two varieties of Egg Plum—the Red and the Yellow—and, of course, from Victorias. Other varieties are used, but are best mixed with one of the above. As with blackcurrants, the fruit should be boiled until tender before the sugar is added.

For stoneless plum jam the stones may be removed entirely by sieving through a coarse-mesh sieve, but even when the ordinary varieties with stones are being prepared it is often desirable to make up the fruit with about two parts of ordinary unstoned fruit and one part of sieved fruit. Too many stones are objectionable and detract from the final appearance of the jam.

Sugar and Other Ingredients

Of the other ingredients for jam, the most important is sugar. It is immaterial whether cane or beet sugar is used, but in either case a good grade of unblued sugar is preferable. The sugar is best added to the jam in the form of a syrup, the usual strength being a 66 per cent. solution in water—*i.e.*, 100 lb. of sugar dissolved in 5 gal. of water. Syrup made in this way will invariably contain small amounts of foreign matter such as hairs from the sugar sacks and bits of black foreign matter, and it should therefore be filtered before entering the jam pan. Special pans having a self-contained filter pad may be used, or the syrup may be run by gravity to the jam pan through a fine piece of muslin.

Some manufacturers use, in addition to cane or beet sugar, a proportion of glucose or invert sugar, but this practice is more easily dealt with under the heading of granulation.

Pectin is a necessary ingredient for most jams, but it should be regarded, not as an adulterant, but as something which is added in order to make up for a deficiency of natural pectin in the fruit. Pectin is obtainable as a powder and in liquid form (in about 5 per cent. solution), and either may be used. Liquid apple pectin has the advantage of being cheaper and possibly more convenient to handle in the factory than the powdered varieties. On the other hand, the use of powdered citrus pectin may be preferred on account of the complete absence of flavour and odour, and it also has the advantage of being of uniform setting power. Apple juice, or pomace, is sometimes used instead of pectin, but this practice is less common than it used to be on account of the fact that the jam prepared from it becomes, in reality, a mixture.

Of the remaining ingredients we have left only *colouring matters* and *acids* (usually tartaric or citric). In the case of the former all information may be obtained from the usual manufacturers of these, but care should be taken to ensure that only permitted colours are used. When solid colours are used it is better to make up solutions in water, about 1 oz. to the pint, for factory use. Also, when using citric or tartaric acid, it is usually more convenient to use a 50 per cent. solution in water—*i.e.*, 10 lb. of acid to 1 gal. of water.

Plant

The plant required for a jam factory will depend, of course, upon the quantity to be made, the available space, and the type of premises to be used. A quick way of weighing the ingredients and of transferring them to the pan is essential, and quick-boiling pans are always a necessity. It will perhaps be better to consider first a plant of moderate capacity—say, 5 to 10 tons of jam per day—and later to indicate briefly some modifications which may profitably be introduced in larger plants.

As mentioned above, the syrup is usually made first on

an upper floor, by boiling the weighed quantity of sugar with the requisite amount of water, with, or without, the addition of invert sugar or glucose. The boiling of the sugar syrup may be carried out in 40- to 50-gal. copper or aluminium steam-jacketed pans, suitable for working with at least 80 lb. per square inch steam pressure. One syrup pan will be required to each jam boiling pan, and by regular working from left to right and numbering the boilings the jam boiler working on the floor below can proceed in the same order with precision and speed, each jam boiler having about six pans to control at a time. The finished jam is then run into coolers, usually again made of copper or aluminium, in which it is weighed and passed to the filling room.

In larger plants the boiling is usually still carried out in 40- to 50-gal. pans, but the pans are fed with the ingredients by conveying systems from automatically controlled weighing devices. When boiled the jam is run by gravity, or pumped, to enclosed coolers provided with brine coils, and when the desired temperature has been reached the water automatically cuts out and the jam is filled.

Spraying Apple Trees.

Recipes

It would obviously be impossible here to give recipes for all types of jam, and indeed if this were so they would be of little use to the manufacturer. Apart from differences in the type of jam required, the working conditions and the fruit available at individual factories might easily make such recipes unsound. It may be useful, however, to consider a few points concerning the making up of recipes, and to illustrate these points with one or two examples.

Of first consideration is the size of the boiling. The economic aspect demands that the boiling should be as large as possible, since the labour and overhead charges will be reduced to a minimum. On the other hand, it is desirable to keep the size of the boiling small for several reasons. In order to get efficient and quick boiling, the ingredients should not fill the pan much above the steam jacket level, while if the level falls below this point caramelisation may occur, resulting in a poor colour. Also, many jams exhibit a tendency to boil over and froth if the pan is unduly full. Another important point to be considered is that the smaller the volume of the jam, the greater will be the cooling surface it will give in the cooler.

Considerations of the above have led manufacturers to adopt various sizes of boilings, and final weights of 100 to 200 lb. are common. Having decided on the size of the boiling and the proportion of fruit which is to be used, the next important point to consider is the soluble extract, since the keeping quality of the jam is largely dependent upon the maintenance of a correct percentage of soluble matter. All the materials used for jam contribute to the soluble extract, but the most important ingredients in this respect are the sugar and the fruit, and in calculating the soluble extract of a recipe usually only these two ingredients are taken into account, in conjunction with the final weight of the boiling. In jams where a large amount of liquid pectin is used, allowance should also be made for this. The following figures show the approximate soluble extract of some ingredients:

Sugar	100 per cent.
Glucose	82 ,, ,,
Pectin (liquid)	12 ,, ,,
Blackcurrant pulp	11 ,, ,,
Plum pulp	11 ,, ,,
Strawberry pulp	10 ,, ,,
Apple pulp	9 ,, ,,
Redcurrant pulp	6 ,, ,,
Raspberry pulp	3 ,, ,,

From such figures the soluble extract of a jam made to a given recipe can be calculated fairly accurately, but due allowance should be made for any invert sugar formed from the cane sugar during boiling. During the conversion of cane sugar to invert sugar the soluble extract is increased by 5 per cent., so that if 20 per cent. of the total sugar in the jam is inverted during the boiling the soluble extract of the jam is increased by 1 per cent. for each 100 lb. of sugar present. Two practical recipes will probably suffice to illustrate the manner of calculating the approximate soluble extract.

Recipe A.

Raspberry pulp	49 lb.	
Sugar	74 ,,	
Pectin	7 ,,	
Water	17 ,,	
Total ...	147 ,,	
	112 ,,	jam
To boil out ...	35 ,,	

Recipe B.

Strawberry pulp	59 lb.	
Sugar	72 ,,	
Pectin	8 ,,	
Water	20 ,,	
Total ...	159 ,,	
	112 ,,	jam
To boil out ...	47 ,,	

	A.	B.
Extract from fruit	5% of 49=2·45 lb.	10% of 56 =5·6 lb.
Extract from sugar	74·00 lb.	72·00 lb.
Extract from pectin	12% of 7=0·84 lb.	12% of 8=0·96 lb.
Assuming 20% inversion of the sugar	20% of 5% of 74 =0·74 lb.	20% of 5% of 72 =0·72 lb.
Total extract in 112 lb. jam	76·03 lb.	79·28 lb.
Percentage soluble extract	$\frac{76·03 \times 100}{112}$ =68%	$\frac{79·28 \times 100}{112}$ =70%

If the soluble extract is low (as in A), more sugar should be included in the recipe, while if it is too high the amount should be reduced.

Acids (either citric or tartaric) are often included in jam recipes to make up for a deficiency of natural acids, so as to increase the amount of inversion. It will be seen later that the amount of inversion is a very important factor in preventing granulation. If the percentage of invert sugar is lower than about 25 per cent. acid should be added; amounts up to about 1 oz. per 112 lb. of jam will be found to be sufficient, but the amount required will naturally depend upon not only the original acidity of the fruit, but on the length of time taken to boil and fill the jam.

Boiling

The correct boiling of jam is fundamentally important, and such troubles as fermentation, granulation, bad colour and flavour, moulding, and bad set can usually be traced to faulty boiling.

The fresh fruit or pulp is first weighed out, together with the water, and the steam is turned on. In the case of most fruits it is necessary to boil these two ingredients for a few minutes, either to soften the fruit or in order to remove some of the SO_2. In the case of blackcurrants, extra water may need to be added at this stage so that the time of boiling is increased, in order that the final amount of preservative in the jam will be below the maximum permitted amount of 40 p.p.m. If this water is added at a later stage the longer boiling period may produce over-inversion, which will ultimately cause granulation.

After a few minutes' boiling, the sugar syrup is added, together with any colouring matter or acid. A small amount of a fat, such as butter or nut oil, should also be added to prevent frothing and the consequent formation of scum. About five minutes before the end of the boil the pectin should be added; if it is added too early some of its setting properties will be destroyed, owing to the formation of pectic acid. The finish of a boil should be judged by the "drop" test and by the temperature, and whenever practicable as many boilings as possible of the same variety of jam should be made consecutively, so that, when one has been judged to be correct, the remainder may be judged practically solely by the temperature as shown on the thermometer.

The temperature at which a boiling finishes is determined by the concentration of solids at the moment when the correct set is obtained, as shown by the drop test. The soluble solids should be at least 70 per cent. when finished, so that the highest finishing temperatures are attained with jams made from fruits with the highest natural sugar content—such as strawberries—and lowest in those with lowest sugar content—such as apples. The difference is not great, however, and the thermometer must be carefully watched; in the two instances above, for example, the former would finish at about 222° to 224° F., and the latter at 219° to 221° F. In boiling a series of batches of the same variety of jam and finishing at a certain temperature, due regard should be paid to variations in the barometric pressure, and many jam boilers find it worth while to check up from time to time on a barometer fixed in the boiling-room. Changes in the atmospheric pressure have a far greater effect on the finishing temperature than many jam boilers realise. A drop of 0·3 in. in barometric pressure reduces the boiling point by 0·5° F., and it therefore becomes necessary either to make frequent drop tests or to make the necessary allowance in temperature by frequent reference to the barometer.

Picking Pears in South Africa.

Since the finished weight of a boiling is dependent upon the time of boiling, this gives an additional check on the correctness of the boil. Using the same recipe, the maximum tolerance should be ± 1 lb. in a 112-lb. boil. The finished weight can be checked by tipping into a tared cooling pan.

It is of great importance when boiling several batches

of the same variety of jam that the conditions should be as nearly as possible identical in each one. As mentioned above, the first boiling is somewhat in the nature of a test boiling, and if the set, the soluble extract, and the percentage of invert sugar are found to be correct, then not only should the finishing temperature (corrected according to the prevailing barometric pressure) and the final weight be constant, but the length of time of the boil should be the same, and each ingredient should be added to the pan at the same stage. This can easily be done if the steam pressure on the boiler is maintained at a constant level and if the steam traps are made to function properly, provided routine methods of boiling are adopted. If care is taken the soluble extract and invert figures should not vary, but these should be checked by analyses at frequent intervals throughout the day.

Filling

After boiling, the jam is transferred to the coolers. There is a diversity of opinion as to how far jam should be cooled before filling, but most manufacturers fill at 180° to 200° F., as it is considered that lower temperatures foster pre-setting and spoil the final set of the jam. It is not advisable to fill jam much above this temperature on account of the fact that the fruit and stones often show a marked tendency to float, causing an uneven distribution in the jars. Jam may be filled either direct from the coolers by hand or, after transferring to a feed tank, by machine. In either case the jars, after filling, should be allowed to cool as quickly as possible in order to avoid further inversion of the sugar and to preserve the colour.

Tissuing

Jam is tissued for several reasons: it prevents extraneous matter from entering the jars, and the jam is protected from bees and flies. But tissues are of use chiefly in retarding the growth of moulds. Tissues should be impervious to moisture and they should be securely sealed to the sides of the jars. Air bubbles between the surface of the jam and the underside of the tissue should be avoided, and for this reason tissuing is best performed while the jam is still hot.

Closures

Before the advent of metal tops for jam, parchment tie-over tops were used, and although these are satisfactory if the jam has been boiled to give the correct soluble extract, and if stored under favourable conditions, bad storage conditions are liable to cause trouble. Parchment tops are permeable to both air and water vapour, and the latter will be absorbed by the jam in a damp atmosphere and will be given off in a dry atmosphere. In the former case mould may develop, and in the latter case crystallisation may occur.

In addition to the ordinary parchment tops there are many sorts of closures which, although not producing a perfect seal, are not permeable to any great extent to air and water vapour, and the use of these may cause trouble from moulds under unsatisfactory storage conditions, due to the leakage of water vapour under the top and subsequent condensation underneath. For this reason, and others, many manufacturers have adopted metal closures, of which there are several patented types available. Some of these rely on a rubber ring to produce a seal on to the glass, while others use tops with rubber solution run in. In either case a complete seal is obtained, with the result that external atmospheric conditions do not affect the keeping qualities of the jam. When metal tops are used, however, it is essential that the jam be sterile at the time of sealing. To produce sterile conditions in the jar, not only must the jam itself be sterile—as is usually the case immediately after boiling—but the inside of the cap and the headspace between this and the surface of the jam must be sterile. This may be effected either by inverting the jars of hot jam immediately after filling, while the temperature is still about 180° to 190° F., or by passing the jars in their normal upright position through a steriliser, heated by steam or other means, the main body of the jars being shielded from the heat so as to avoid discoloration and over-inversion.

"Manufactured" *versus* "Home-made" Jams

(Continued from next page)

per cent. for each grade, the figure being taken as that indicated by the refractometer reading when cold, not corrected for insoluble solids.

How is it possible for the housewife to ensure that her home-made jams may conform to this standard? In some cases, no doubt, home-made jams contain more than this minimum requirement of solids; often, it is to be feared, the percentage of solids falls far below the requisite figure.

Not only has the manufacturer all modern conveniences for jam production, but his pans and heating plant have been specially designed to ensure the best results. Pans used in the home are commonly not intended for jam making, but are made "to do" for the purpose when occasion arises.

Practically the only advantage that can be claimed for home-made jam over the factory-made article is that the fruit can be gathered, prepared, and converted into the finished product straight away, without the need for transport and the possibility of damage which it entails. But this applies only to jams made under ideal conditions, where the housewife grows her own fruit. When, as is more commonly the case, she has to purchase her fruit from a shop, she is definitely at a disadvantage as compared with the jam manufacturer, as regards both price and the freshness of the fruit purchased.

Many folk imagine that it is cheaper to make jam than to buy it. This is an illusion, which a little careful book-keeping would serve to dispel. If time, labour and cost of fuel are taken into account, in addition to the cost of all the ingredients, it will be found that the economies which large-scale production enables the manufacturer to effect more than compensate for the profit he asks in return. Apart from economies in manufacture, he is, as a large consumer, able to purchase his fruit at a much lower price than the housewife. He buys direct from the grower, and the middleman's profit, which the housewife pays, is eliminated. Indeed, it may be confidently asserted that to-day it does not pay to make one's own jam.

"MANUFACTURED" *versus* "HOME-MADE" JAMS

Some Selling Points for Jam Manufacturers

By J. G. F. DRUCE, M.Sc. (Lond.), R. Nat. Dr. (Prague), F.I.C., F.C.S.

THERE HAS long been a tendency for a section of the public to express a preference for home-made jams. These, it is popularly thought, are bound to be purer, better, and more wholesome than the products of the factory. Townsfolk, in particular, are attracted by the slogan "home-made", and will even pay a higher price for an article so labelled, which may have been prepared in a back kitchen under conditions far from hygienic, and from materials which would have been rejected by a modern jam manufacturer of repute.

Jam Making an Applied Science

The fact remains that manufacture on the large scale permits of accuracy in composition and the adoption of methods of scientific control which are quite beyond the means of the housewife. Jam making has evolved from a domestic art into a highly specialised branch of applied science, and, at its best, jam manufactured on a large scale represents a very big advance on the home-made article.

Evidence that home-made jams have not always been considered satisfactory is provided by the present popularity of various pectin preparations which have been placed on the market for sale to housewives to ensure the successful setting of their conserves. But, although careful attention to the directions supplied with these will, in general, lead to products of improved consistency, this cannot be compared, in point of efficiency, with the more precise methods and control which large-scale factory production makes possible.

In the end, quality always counts. Meantime, it should be advantageous to jam manufacturers to bring home to the jam-eating public some of the reasons why modern large-scale methods make possible the production of jams superior in quality to the home-made articles.

The Importance of Control

The manufacturer's experience, scientifically utilised, enables jams to be made complying with definite standards of quality, taste, and appearance. On the other hand, home-made jams usually show big variations in these essential characters. This is almost inevitable. Leaving aside variations in the quality of the fruit, housewives are notoriously careless in the weighing of ingredients, and such means of temperature control as they have at hand are usually of a relatively primitive type and, it might be added, are rarely used even then. The housewife is definitely at a disadvantage in maintaining optimum temperature conditions and in judging when the batch is done.

In spite of advances made in recent years in elementary, secondary, and technical education, it is to be doubted whether more than a minute fraction of British housewives knows what a *p*H value is, and even those who have some theoretical knowledge of the subject usually lack the means, not to say the inclination and the technique, to make a *p*H determination.

It is, however, now about ten years since the independent researches of Ogg in Great Britain and Tarr in America established the fact that mixtures of pectin and sugar, free from acid, would not gel in aqueous solution, and further that the character of the gel resulting when acid was added depended, not upon the total acidity, but on the hydrogen ion concentration. It is, therefore, of prime importance for the *p*H value to be correctly adjusted if a jam of first-rate quality is to result.

It is well known, for example, that red currants, some gooseberries, and certain other fruits are particularly rich in fruit acids. From the jam manufacturer's point of view, the acid content is excessive. However, it is quite possible for him to make the necessary adjustment under conditions of analytical control. The housewife either fails to make any adjustment, or is guided purely by rule of thumb which, sometimes successful, must on other occasions lead to failure.

On the other hand, some fruits, notably strawberries, are deficient in pectin, and unless special means are taken to remedy this defect by the addition of some fruit rich in pectin, or of pectin itself, they will not form satisfactory gels. It is notorious how thin and watery home-made strawberry jam is in nine cases out of ten.

In the making of mixed jams, moreover, the manufacturer's experience is of great value in enabling him to offer consumers those combinations of fruits most likely to please their palates. The probability of success in this direction is much greater than when jams are made by chance methods over the domestic stove.

The Federation Standards for Jams

Actually the Food Manufacturers' Federation in collaboration with the Society of Public Analysts has laid down certain standards for two grades of jam, labelled respectively "Full Fruit Standard" and "Lower Fruit Standard". Standards for mixed jams are included, the proportions of the fruits entering into the mixtures being stated. Although the figures are available, and can be safely taken as representing the results of long experience, it is doubtful whether one housewife out of a hundred avails herself of them in her domestic jam making.

The percentage of total solids is another factor of great importance, and has been fixed at a minimum of 68½

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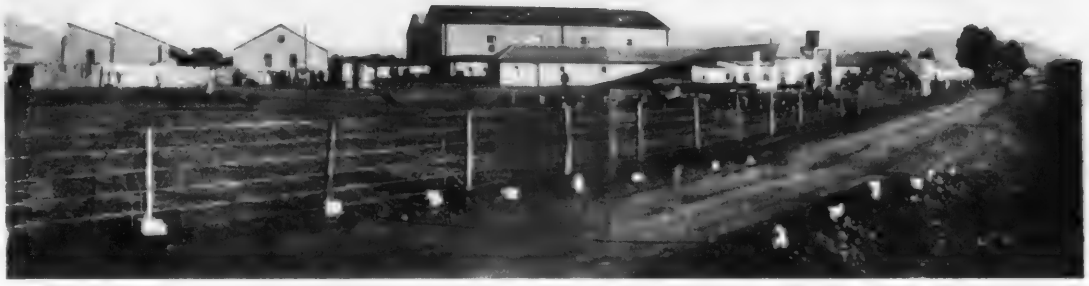


General view of the packhouse, wilting rooms, cull house, and girls' hostel at an orange packing station in Rhodesia.

MOULD WASTAGE IN CITRUS FRUITS

By George Robson, B.Sc.,
Rhodesia

ONE OF the most serious problems that confronts the citrus grower is the development of mould wastage among his fruit during transit. At the marketing end the arrival of a wasty consignment immediately tends to depress prices. A series of wasty consignments from the same country may adversely affect prices throughout the season. More important still, the reputation of such fruit, which may have taken years to build up, may be destroyed in as many weeks.

Causes of Decay

Most of the common citrus fruit decays are due in the first place to a rind injury. This is certainly the case with the common blue and green moulds caused by the fungi *Penicillium italicum* Wehmer and *P. digitatum* Sacc. respectively. Recent research has indicated that the oil vesicles in the rind form a convenient avenue for infection by both blue and green mould. The other skin tissues are apparently immune to shallow infections by these fungi, although deep infections usually cause decay. This immunity may be due to lack of suitable food materials for the germinating spores or possibly to the mechanical resistance of the cell tissues themselves, or even to a combination of these factors. Both blue and green mould are capable of spreading by contact.

It is obvious, therefore, that the utmost care must be taken at all stages during the picking, packing, and handling of citrus fruits. This point is naturally frequently emphasised in citrus literature, and some authors have gone so far as to state that wastage may be entirely eliminated by proper handling methods. This is, however, overstating the case, since the personal factor must be taken into account. It is indeed impossible in practice to avoid a certain amount of injury taking place; consequently various sterilising treatments have been introduced to supplement careful handling operations.

In passing, it may be mentioned that different varieties of citrus fruits show different susceptibilities to mould wastage. Of the common export varieties, the Washington Navel is undoubtedly the most susceptible and the Valencia Late the least.

Liquid Fungicides

One of the most successful fungicides used to control citrus fruit decay is borax. A warm 5 per cent. solution in water is generally used and the fruit immersed for several minutes in a tank at the start of the washing operation. Excellent control of green mould is obtained with borax, but the results with the blue mould are less satisfactory. Mixtures of borax and boric acid are also used, but suffer from the same defect as borax alone in the case of blue mould.

Some years ago tests were made in South Africa with borax-impregnated wrappers instead of the normal sul-

Early stage of stem-end rot in Valencia orange, associated with Colletotrichum glœosporioides and sometimes Alternaria citri.

phite paper wrapper. The preliminary results were very promising, but, unfortunately, the investigation was discontinued for some unknown reason. From the commercial viewpoint, a wrapper incorporating a fungicide that would afford some control of decay would be an excellent innovation. Further work on these lines is obviously desirable.

Considerable litigation was occasioned in the United States when the holders of the patent rights for the use of borax in the prevention of citrus wastage began to enforce their rights to royalties. Search was made for alternative fungicides, and a 3 per cent. solution of bicarbonate was found to answer very well. Curiously enough, although sodium bicarbonate is more effective than borax against the blue mould, it is less effective against the green mould.

Some work has been done regarding the exact manner in which sodium bicarbonate prevents wastage. It is believed that it is the bicarbonate ion that is toxic to the fungi. When the spores germinate, a saturated solution of sodium bicarbonate formed from the thin film of salt left on the rind after treatment is supposed to act on the protoplast of the thin-walled germ tube or possibly on the spore itself at the point of emergence of the tube.

Picking Valencia Late oranges in Rhodesia.

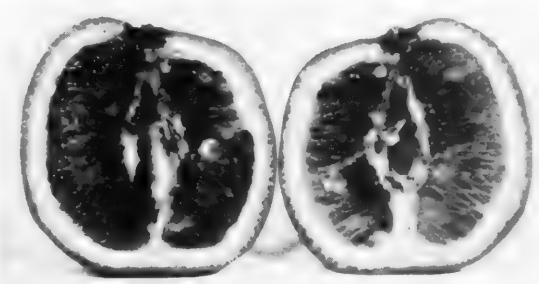
Another liquid fungicidal treatment that has been suggested is water glass or sodium silicate. A 2 per cent. solution of 41° Baumé is stated to give control of the blue and green moulds.

The chief objections to the use of a liquid fungicide are the expensive and cumbersome plant required and the fact that reinfection may occur. Pure food laws also legislate against the use of this class of fungicide. In the United States, however, a clean, polished fruit is demanded by the public. To supply the demand practically all the packhouses are fitted with colouring (ethylene process), washing and drying, and polishing plants. The last process consists in either spraying the fruit with a fine jet of warm paraffin wax or, alternatively, passing the fruit through brushes which revolve on top of paraffin wax slabs. A wax coating of this nature cannot, however, be applied with safety to fruit taking several weeks from packhouse to market, as undesirable metabolic changes are likely to take place within the fruit.

Gas Fungicides

The second general method of preventing wastage is by gases possessing fungicidal properties. Successful gas storage of meat and eggs depends in part upon the bactericidal and fungicidal action of carbon-dioxide. On the other hand, carbon-dioxide is not so effective in preventing decay among fruit and vegetables, largely because the fungi concerned are not very sensitive to the gas until it is present in such high concentrations as to affect the flavour and carrying properties of the fruits and vegetables concerned.

Acetaldehyde and ammonia have both been suggested for the treatment of citrus fruits. Ammonia is particularly toxic to the spores of both blue and green mould at comparatively low concentrations. Unfortunately, the gas is awkward to handle and in practice it is extremely difficult under existing conditions to maintain the requisite concentration for any length of time. Furthermore, both acetaldehyde and ammonia cause undesirable skin blemishes at certain concentrations (higher than necessary to kill spores), while the flavour of the juice may also be affected.



Centre rot in Valencia Late orange due to Alternaria citri.

Ammonium bicarbonate has been suggested as a suitable source of ammonia for use with oranges. Preliminary tests have shown, however, that the amount of ammonia liberated varies, and severe skin blemishing is liable to occur under practical conditions. On the other hand, ammonia is said to have been successfully introduced on the Continent for the air conditioning of large warehouses used for the winter storage of cabbages.

Transferring boxes of oranges from mule waggon to motor truck.

Another gas treatment has received attention in California as a means of reducing decay in citrus fruits. This gas, under the trade name of "Agene", is nitrogen trichloride and has been used for many years for maturing and improving the colour of flour. Owing to the nature of the gas it has to be used immediately it is made, and the process is owned and run by a proprietary company. "Agene" shows much promise as a fungicide against the common citrus-decaying fungi. Concentrations of as low as 4 to 6 mgm. per cubic foot for a period of 30 minutes are said to be lethal to *Penicillium digitatum* and *P. italicum*. Mycelium of *Phytophthora citrophthora* (brown rot) and spores of *Colletotrichum glœosporioides* (anthracnose) and *Alternaria citri* were similarly sensitive. Large clumps of mycelium, however, were not killed by these low concentrations.

During storage for 8 to 10 weeks, decay may be reduced in the case of oranges by 50 to 75 per cent. when treated with nitrogen trichloride at 15 mgm. per cubic foot. It is recommended that 3 to 5 treatments (3 hour treatments at 3- or 4-day intervals beginning the first day of storage) should be given.

Boxes of oranges en route to rail head.

Commercially it has been found desirable to gas the fruit for approximately 6 hours the first time it is gassed, so as to ensure penetration to the centre of the boxes and to maintain the conditions for a sufficiently long enough time at a concentration fatal to the spores.

The recent developments in gas-tight holds for meat storage in ocean-going vessels would seem to indicate that the time is not far distant when tropical and sub-tropical fruits will be transported overseas without loss of flavour or excessive decay.

Transferring boxes from motor truck to train.

These pictures and those on next page were taken by the author in Rhodesia.

CITRUS MATURITY TESTS

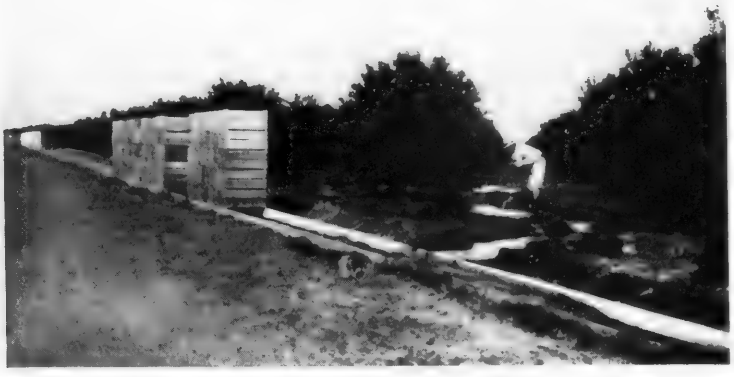
Empty Boxes passing to Steriliser.

THE COMPOSITION of oranges and other citrus fruits changes during ripening. The palatability of oranges is largely conditioned by the so-called sweetness or balance between sugar and acid contents. Intensive competition in European markets has caused most citrus exporting countries to pay particular attention to fruit quality. Consequently maturity tests are designed to prevent the export of immature fruit, to raise the general standard, and to preserve some degree of uniformity.

Thus California has long enforced the so-called 8 : 1 test for oranges. This test requires that the juice shall contain soluble solids equal to or in excess of 8 parts to every part of acid calculated as anhydrous citric acid. A rider is added to the effect that when the colour is at least 70 per cent. at the time of picking, then a minimum ratio of 6 : 1 is allowable. On the other hand, no fruit may be artificially coloured unless the ratio is at least 8 : 1.

South Africa also enforces maturity tests on export oranges. The soluble solids : acid ratio is again used as a criterion of quality, but the minimum ratios adopted vary with the type of fruit and are substantially lower than the California standards. Washington Navels, for instance, must show a ratio of at least 6·5 : 1, Valencias 6·0 : 1, and Seedlings 5·5 : 1. There are, however, various amendments designed to prevent the export of sour and insipid fruit respectively. On the whole, the South African regulations are much more comprehensive than those of other citrus-exporting countries. For example, a minimum juice content is required; the packed boxes must be a certain minimum weight according to the count; while all consignments are carefully examined for wastage at the port of shipment.

Basin System of Irrigation.



Australian oranges are subjected to a maturity test based on acid content only, the minimum standards being intermediate between those of South Africa and California. There is reason to believe that a maturity test based on acid content provides a more accurate index of quality than does a soluble solids : acid ratio. It appears that the Brix hydrometer method of determining soluble solids possesses several limitations giving rise to quite appreciable errors in the reading. The acid content test, on the contrary, is highly accurate and possesses the advantage of being simple to apply in practice. Whatever the basis of testing, however, the final choice lies with the consumer. A careful study of the market requirements in this respect must therefore be the guide for all citrus growers.

G. R. (*Rhodesia.*)

MILK IN BREAD

Ignoramus now deals with points raised by Mr. Shortt in the course of this discussion, and the latter makes a final reply to his critics.

THE EDITOR of FOOD MANUFACTURE has asked me, along with Mr. Shortt, to wind up this discussion, which is a pity, in a way, since the discussion seems almost automatically to have run down. However, editorial mandates are not lightly to be disregarded, and I will attempt briefly to restate my position and also to say why I hold that none of the interesting contributions following my first article necessitate my altering that position.

Mr. Thomas was quite wrong (as I believe he now knows!) in thinking that I represent the baker's point of view, and Mr. Shortt was quite wrong in thinking that I object to the inclusion of milk in bread. In so far as I am biassed towards any commercial view, it is towards that of the farmer, for the organisation with which I am associated manufactures and sells dried milk, and nothing would please it or me more than an increased demand for this product by bakers. What I did, and still do, oppose is the introduction of a legal compulsion to include milk solids in bread.

Question of Cost

For the reasons that I set forth in my first article and that have not, in my opinion, been in any way controverted, I still believe that it is impossible to replace flour in a given weight of bread by the more expensive milk solids without—

(*a*) increasing the price of the loaf, or
(*b*) increasing the water content of the loaf, or
(*c*) both.

Any of these proceedings would, in effect, increase the cost of bread to the poorest section of the community; at a time when the average *per capita* consumption of calories by the whole population is below what it should be, and the average *per capita* consumption of calories by the poorer sections of the population is very much below what it should be, I can only view with misgiving any proposal that would tend still further to depress that average. I did not expect any instruction in nutrition from Mr. Shortt, and he apparently is not anxious to give it; I am not in the least blind to the importance of protein, minerals, vitamins, and other food constituents, over and above the basic energy needs; but I do try to keep my sense of proportion in these matters and to remember that, with many millions of unemployed and partially employed families all over the world to-day, it is not good nutritional politics to introduce measures liable still further to increase the amount of actual starvation in the world.

If Mr. Shortt can persuade the baking fraternity that the introduction of milk solids into bread will so improve their bread that they can get a higher price for it, leaving it to the bakers to obtain this higher price from those sections of society that can afford to pay for it, well and good. Mr. Shortt and I will both rejoice. What I want to avoid at all cost is, first, a further pauperisation of the poorest sections of the community by what would be, in effect, a significant increase in their cost of living or a significant diminution in their calorific intake, and, secondly, and far less important, a compulsion on myself always to eat milk bread, though I may much prefer water bread.

The highly complex arguments about scaling weights and so on, in which Mr. Bennion and Mr. Thomas have joined issue with Mr. Shortt, I can safely leave to the baking experts to fight out among themselves. The English baker is, doubtless, as conservative as most other English tradesmen, and is not likely to be rushed off his feet into adopting American practices that would not be successful in this country. On the other hand, it is very good for the English baker to have to stand up to the hurricane propaganda of Mr. Shortt and other Irish-American enthusiasts. Good luck to them!

Milk Consumption

Finally, since I based the whole of my case against compulsory lactification on grounds that are primarily nutritional, I want still to say emphatically that no case whatever has, in my opinion, been made out on nutritional grounds for the proposal to which I have taken exception. I pointed out that the average daily intake of milk in this country is $\frac{1}{3}$ pint and that it ought to be increased sixfold. I endeavoured to show that the *maximum* increase that would be reached by the compulsory lactification of bread was $\frac{1}{7}$ pint. It is preposterous for Mr. Shortt to answer, with evident glee, that this "would increase the present milk consumption by nearly 50 per cent". This is not argument; it is just juggling with figures.

Although I do not go the whole way with Professor Winifred Cullis, who is reported recently to have stated that skim milk contains no vitamins, I do protest against the assumption that to consume the dried non-fatty milk

solids from ½ pint of milk is the nutritional equivalent of consuming even ½ pint of whole milk. None of the fat, or of the even more important fat-soluble vitamins, is present in separated milk powder, and it is not permissible to make nutritional equations with substances of different nutritive value.

I am still of opinion that, for a given amount of propaganda and effort, whether directed by state, semi-state, or commercial organisations, more nutritional good would be done by a "Drink more Milk" campaign than in propaganda for compulsory lactification of bread. The appeal is more direct, and the economic consequences are more easily foreseeable, quite apart from the fact that the nutritional benefits would almost certainly be greater.

Surplus Milk

There are other remarks by Mr. Shortt to which I might also take exception. For example, I quoted figures from the Milk Marketing Board showing that they anticipated having last spring 40 million gallons a month of surplus liquid milk, but I queried whether, averaged over the whole year, the daily requirement of 800,000 gallons would be reached, since the 40 million gallon surplus was only anticipated during the flush months. Commenting on this, Mr. Shortt calmly says that "there is enough waste and surplus milk in England and Wales alone to provide 480 million pounds of fat-free milk solids annually". This represents an amount of milk nearly double the 800,000 gallons per day to which I refer, and Mr. Shortt gives no reason whatever for believing that this surplus actually exists. Again, to point to the importations of butter and cream at the present day as an answer as to how we are to dispose of still more butter and cream if we produce it locally is to ignore so many economic difficulties connected with overseas trade that it is obviously impossible even to begin to discuss them here.

Compulsory Lactification

No, Mr. Shortt, with all respect, and though I wish well your attempts to sell milk solids to the baking trade, I suggest you employ your undoubted polemical ability and your still more obvious enthusiasm in answering the arguments of men like Mr. Thomas and Mr. Bennion, who say that your proposals will bring nothing like the economic benefit to the baker that you claim, rather than to confusing the perfectly simple issue originally raised by me. I am opposed to legal compulsion to include milk solids in bread. This was introduced in Germany, with a prohibition to the baker to increase the price of bread. The result has been that the separated milk, for which the baker has had to pay anyhow, has been put down the drain. The law is to be accordingly modified. In a part—and in a very near part—of the Empire, compulsory lactification of bread is about to be introduced, but the baker will be permitted to pass the price on to the public. My informer stated quite frankly that the proposal was being done in the interests of agriculture and that the consumer would have to pay. He added: "Who cares about the consumer, anyhow?"

The Consumer

I do care about the consumer, and I was writing as much from his point of view as from that of the nutritionist. I have already occupied more space than the Editor really wants me to have, and I will not therefore enter into any further discussion on whether we should be satisfied to have bread "the staff of life" or whether we should support various efforts to make it the staff "with knobs on". I like bread, and particularly English "household" bread, as it is, and I am convinced that there is one thing, and one thing only, that will increase the popularity of bread, and that is not the loud advertising, with or without justification, of all sorts of novel nutritional qualities. If the baking technologist can, however, produce a loaf that will remain "new" for four days instead of for twenty-four hours, then indeed we may see some small increase in the consumption of what remains, after all, one of the most palatable of all human dietary constituents.

Some of the participants in our friendly polemic seem to think that I adopted my curious pen-name in order to indicate to all comers that I did not pretend to know anything about the subject. To them I would only say that the proper translation of the word "ignoramus" is—"we do not know". If I may close with a Latinism, *Verbum sapientibus*.

MR. SHORTT'S REPLY

In this my concluding article in Food Manufacture on the subject of Milk in Bread I shall disregard all statements made by the triumvirate of opposition that are remote from the question at issue and will confine my attention to only those arguments that are relevant.

Messrs. Ignoramus, Bennion and Thomas rank fairly well together as food economists. They all agree that milk bread is a most desirable thing, but all oppose it for nine reasons, most of which are unworthy of serious consideration.

They are as follows:

(1) Legal compulsion for the use of milk in bread.

(2) Scarcity of raw material for the production of adequate supplies of fat-free milk powder.

(3) Milk bread dries out sooner than water bread.

(4) Its cost is prohibitive.

(5) It would tend to reduce the *per capita* intake of calories.

(6) It would tend still further to increase the amount of actual starvation in the world.

(7) It would tend toward a further pauperisation of the poorest sections of the community.

(8) The farmer would benefit first and foremost.

(9) Milk does not materially improve the nutritional quality of bread.

If these nine basic points of opposition were not so ridiculous they would, certainly, constitute a formidable barrier to the use of milk in bread. But ridiculous as they are, it is my simple task to take them one by one and discredit them.

The Milkman

We will absolve Ignoramus from objection No. 8, for in so far as he is biased towards any commercial view it is towards that of the farmer. This I take to mean that he has a leaning for the farmer because he urges the daily *per*

capita intake of one pint of milk, which, in this country, would mean the consumption of over two billions of gallons of milk per annum. This is, of course, the dream of the milkman. In the present stage of milk production in Great Britain, such an intemperate indulgence in milk drinking would wipe out the production of butter, cream, cheese, casein, powdered milks, ice cream, infant foods, and numerous other food products in which milk is a component part; to say nothing of the interference with other drink industries. There is another phase to this milk drinking that I will deal with later in relation to its influence on bread consumption.

Ignoramus attempts to drive home objection No. 1, when he says: "What I did, and still do oppose, is the introduction of a legal compulsion to include milk solids in bread." Well, everyone, with the single exception of Mr. Thomas, is opposed to legal compulsion, so the nays have it and that point is ruled out of the discussion.

He still maintains that there is not enough surplus milk in this country to provide 12 lb. of fat-free milk solids for every sack of flour batch of bread. In answer to this I can only suggest that if he, a milkman, will get down to plain farm and dairy statistics, and apply a little simple arithmetic, he will find an abundance of raw materials on the farms and in the factories where cream and butter are manufactured, together with wasted and surplus milk, sufficient to furnish nearly twice the 246½ million pounds of skim milk powder that would be required in the most unlikely event of all bakerdom demanding its share of 12 lb. per sack; so his objection No. 2 is overruled.

He naïvely suggests that I exercise whatever polemical ability I may own to answering the questions of Mr. Bennion and Mr. Thomas; so acting on that suggestion I will leave him for the while with his dairy problem.

Quality of Milk Loaf

In the January issue of FOOD MANUFACTURE Messrs. Bennion and Thomas combined forces. They seemed all "het up" over some laboratory tests I had submitted in my last article. Laboratory men, both of them, they paradoxically discredit the value of laboratory tests, Mr. Bennion suggesting that my test loaves should have been exposed on a barrow to the withering blasts of an east wind for several hours before making my final determinations. Now, I'll confess that I didn't think of that at the time, and I daresay it would be a good idea provided one could conveniently turn on an east wind. Mr. Thomas suggests that he can get any results he desires from a laboratory test. There again I am outdone, for I carried out laboratory work for several years, and for the life of me I couldn't say what the results would be until I made my tests.

But let's get down to brass tacks. Large-scale experiments based on the despised laboratory tests were conducted and all allowances made to conform to mass production. No fat, sugar or malt was used. The loaves, coburg type, were baked in 450° F. for 50 minutes and were then kept unwrapped on open shelves for a period of ten days. The milk loaves were better in appearance than the water loaves, remained fresh longer and weighed heavier than the others, scaled at the same weight. Objection No. 3 is thus disposed of.

Question of Cost

The extra cost for the milk loaves made from two sack batches, into which were introduced 22 lb. of skim milk powder, amounted to ¼ farthing a half-quartern loaf. Mr. Thomas, after a considerable struggle with comparative formulæ I had used to illustrate that milk powder in bread paid for its cost, and after making deductions and allowances to suit himself, came at last to the conclusion that the introduction of 12 lb. of skim milk powder into a sack of flour batch would cost less than an extra ⅛ farthing per half-quartern loaf, but in altering the formulæ he took the fat with its cost out of the water bread and left it with its cost in the milk bread.

Since he submits his figures for my criticism, I will point out that he made a great ado about my error in the cost of fat, but remained silent on the cost I used for the milk powder. Now let us adjust the formulæ so as to make them comparative, eliminating the fat, sugar, and malt from both and costing the milk powder at the market price of 3d. per pound, and the result would be an extra cost of $\frac{1}{12}$ of a farthing per pound of bread according to his own cost figures. As we are all in accord that milk-made bread is most desirable, I ask, should these differences in cost for better bread stand in the way of its more general production? I think not. This, together with the fact that there is no price restriction on milk bread, rules out objection No. 4.

Bread and Milk Consumption

To the question voiced by Mr. Bennion and Mr. Thomas as to whether I am a milkman or a breadman, I will say that were I, like Ignoramus, to preach a doctrine of "Drink more Milk", which drinking can be done only by the replacement of other foods, or, like Mr. Bennion, who proposes to "get people to take more milk, a glass (or a bottle, as is done with school children) with a nice bun or a piece of toast", I could well be classified as a milkman; but, on the contrary, I am interested most in "Eat more Bread", and towards that end I am working for its improvement through the use of milk solids.

Ignoramus knows, and Mr. Bennion should know and make it known to every baker in the land, that 1 pint of milk yields in nutrition the same amount of food solids as 4·3 oz. of bread. If milk consumption was stepped up to their suggestion of one bottle or 1 pint per day per person (an increase of ⅔ of a pint), it would mean an increased intake of milk solids of over 4⅘ million pounds daily, a figure equivalent to the daily intake of over 8 million pounds of bread. Were milk consumption increased to only one glass per day per person in the United Kingdom, increasing the present daily intake from ⅓ pint to ½ pint, it would mean an increased daily intake of milk solids amounting to 1¼ million pounds, or an amount equivalent to the solids of over two million pounds of bread per day. And then we wonder why bread consumption is on the toboggan!

I do not wish to convey the impression that increased milk consumption will result in a corresponding decline in bread consumption to the total extent of the increased intake of milk solids, but I do wish it to be understood that it would result in a corresponding decline in the use of all foods other than milk to that extent, and that the consumption of baked goods would decline proportionately.

Let us, who are interested in baking, not overlook the fact that organised effort is being put into effect to increase the *per capita* consumption of milk in this country. Let us remember that similar organised effort in the U.S.A. has brought about the daily intake of 1 pint of milk per person in that country, an American practice that Ignoramus is striving for and thinks should be adopted here.

Dietetic Values

Now that I'm back to the conservative Ignoramus, who tries to hold his sense of proportion in matters of food economy, let us analyse his sense of proportion. He points out that the use of milk in bread "would in effect increase the cost of bread to the poorer section of the community, at a time when the average *per capita* consumption of calories by the whole population, and particularly by the poorer section of the population, is very much below what it should be". Assuming a somewhat altruistic air, he "views with misgiving any proposal that would tend still further to depress that average", and, fearing a farthing increase in the price of bread, he says: "What I want to avoid at all cost is a further pauperisation of the poorest section of the community by what would be, in effect, a significant increase in their cost of living, or a significant diminution of their calorific intake." But he wants them to take a pint of milk a day!

Now let me do a little pointing out to Ignoramus. A fourpenny loaf of good milk-made bread would yield to his nutritionally impoverished people the same amount of digestible nutrients as is contained in 7½ pints of milk which costs 26 pence, or 6½ times as much as the bread, and the calorific value of the fourpenny loaf is equal to that of the 7½ pints of milk.

Anticipating his criticism that the milk loaf would pro-

vide none of the fat, or even more important fat soluble vitamins, we will provide the equivalent of fat contained in the 7½ pints of milk in the form of 6½ ounces of butter costing a penny an ounce, and we have a combination of food in the bread and butter that supplies 28 per cent. more food nutrients and 50 per cent. more calories than the milk costing 2½ times as much. That disposes of objections 5, 6 and 7.

Ignoramus' sense of proportion in matters of food economy seems to me to be somewhat askew! Mr. Bennion, referring to my last article, misquotes me as saying, "Who cares about the farmers?" What I did say in answer to his statement that the farmer would lose on wheat what he made on milk is, "Who cares about what the farmer loses or gains? Better bread is the question." Now what in the name of goodness has the farmer to do with whether or not milk improves bread? If he loses on wheat what he gains on milk, what of it? Better bread and more of it is the question under discussion, and objection No. 8 has no place in the discussion and is out.

Denying that he delves into the realm of dietetics, Mr. Bennion disparages the values of the milk elements in improving the nutritional quality of bread. He insists that the additional food value imparted to the loaf through the introduction of 12 lb. of fat-free milk solids into a sack of flour batch is negligible, and that I naturally listen to those dieticians who support the views of the interests I represent. Well, the views of the interests I represent are founded on the dictum of authority, as Mr. Bennion puts it, and I do naturally listen to every authoritative statement in this connection. I could here quote numerous widely known nutritionists who, having no axe to grind with any commercial interest, proclaim the nutritional superiority of bread made with an adequate proportion of milk solids not fat, but I choose instead, as a fitting conclusion to this controversy and as a knock-out for the last of the objections to milk in bread, point No. 9, to devote a little space to the following: "The advantages derived from the use of milk powder are as follows:

(1) It confers a delicate flavour on the crumb of the loaf.
(2) It improves the bloom and colour of the bread.
(3) It assists in the production of a thin, biscuit-like crust.
(4) The texture and sheen of the crumb are improved.
(5) It enables the flour to take up slightly more water and the dough obtained to be worked more easily.
(6) It helps to ripen the gluten more thoroughly.
(7) *It increases the mineral content of the loaf and so the value as a food, especially for growing children*"—(quoted from page 53 of Mr. Bennion's book on Breadmaking).

Since Ignoramus closes with a bit of Latin, may I also conclude by saluting my three opponents with *absit invidia*!

FINAL SHOTS

Mr. F. E. Thomas, M.A.

The Editor has—mercifully—limited my remarks to a paragraph, and I have merely to say that I shall be only too pleased to continue this discussion with Mr. Shortt either by letter or by conversation. I would merely summarise my impression of Mr. Shortt's arguments with the remark that they are of the specious variety which might convince bodies such as the House of Commons and—possibly—the House of Representatives, but not the people whom he wants to win over to his side, the bakers. His cause is worthy, but he must realise that, firstly, what appeals, both in arguments and materials, to the American baker will not necessarily appeal to his British compère, and that, secondly, he is treading a very difficult path in his campaign—a far more difficult one, I think, than he imagines even now.

Mr. E. B. Bennion, M.Sc.

As you, Mr. Editor, have limited my final shot to such extreme brevity, I must obey the Editorial dictum.

There is no doubt that the discussion which has taken place in your columns on the use of Milk in Bread has aroused much interest, and, whether or not I agree with all Mr. Shortt's remarks, I must agree with his concluding paragraph, and in doing so say that I do not think it clashes with any of the statements I have made in any of my previous contributions, but is merely a fair-minded summary of the many claims made for the use of milk in bread.

"Ignoramus"

In theory, as the opener of this discussion, I have the final right of reply. Mr. Shortt's "Concluding article", if dealt with faithfully, would involve the writing of many further paragraphs and, incidentally, the restating *ad nauseam* of what has already been stated by Messrs. Bennion and Thomas and myself.

All I want to ask readers of this controversy to do is to read very carefully the four paragraphs headed "Bread and Milk Consumption" in Mr. Shortt's concluding article. Mr. Shortt is, he makes clear, concerned solely with selling more bread; he is quite blind to the fact that the nutritional value of bread solids and milk solids, weight for weight, differ so greatly (as he himself has pointed out more than once) that only ignorance or trade bias could advocate substituting the former for the latter. Reasons of space make it impossible to demonstrate why a 4d. loaf of milk bread plus 6½ oz. of butter, *pace* all pretty phrases like the "amount of digestible nutrients", is not, and never can be, the equivalent of 7½ pints of milk. The interested reader can work this out for himself.

I am still adamant in wanting to see one pint more of milk per day per head consumed on the average in this country, whether or not this affects the sale of cereal products. And I am entirely with Mr. Shortt in agreeing that a tragically large percentage of our population—I say nothing about that of the United States—is not in a position to pay for it. That, however, is a problem for the politicians and economists, and not for the technologists as such. Meanwhile, "hands off the people's calories" is more than justice; it is simple horse-sense expediency.

THE BRITISH CANNING INDUSTRY

The Editor,
Food Manufacture,

Dear Sir,

I have read Mr. Samson's article in the April issue of Food Manufacture, and my opinion is that he has covered his subject comprehensively and intelligently.

If there is one point he has deliberately overlooked, it is the outstanding fact that it cannot be claimed by any means that the lower quality fruit is entirely responsible for unremunerative returns of the canner on top quality goods. Rather the writer thinks that the canner has perhaps unconsciously educated the buyer (by that term is meant the man who really counts in the distributive trade) to put off his purchasing until January, February or March, when the low-water mark is invariably reached, as can be proved from the experiences of the last few years.

The remedy, if this argument is accepted, is obviously to name as his opening prices the lowest prices at which the canners' output could be economically marketed, and thereafter to ask increasingly higher figures to cover the cost of carrying and so forth, for the unsold portion of his stock.

If this policy were persevered with—as was invariably done when the Californian industry was functioning normally—in two or three years the buyer would be converted to the new policy and would do the only logical thing—namely, see that his season's requirements were fully covered at the opening of each season. This would not only place the canner in a strong position, but would enable the industry to assess within reasonable limits the buying capacity of the country.

This is not intended to be in any way an effort to improve on Mr. Samson's arguments, which are excellent in every respect, and he is to be congratulated for having the courage to declare openly what so many of us know to be the truth.

Yours truly,
"Distributing House."

April 4, 1935.

Softening ORANGE PEEL

By T. N. MORRIS, M.A.

IN RESPONSE to enquiries I wish to describe the softening of orange peel for marmalade in greater detail than was done in my book *The Principles of Fruit Preservation*, pp. 60-61. It was stated there that the cut peel needed softening either by prolonged boiling, or, more rapidly, by autoclaving, or by heating in water containing a small percentage of sodium carbonate or ammonia. In a footnote it was stated that the use of small quantities of soda or ammonia in the last process is by no means harmful to the consumer; that the action of alkalies probably consists in removing from the peel many substances which would otherwise toughen when boiled with sugar; and that ammonia is less drastic in its action than soda, probably owing to the fact that the latter attacks hemicelluloses as well as pectoses. It was also stated that arrangements could be made in any of these processes for collecting a proportion of the oil of orange from the peel, and that, if either soda or ammonia was used, the process could be made continuous, the peel being softened in perforated baskets of non-corrodible metal, each containing sufficient for one boiling of marmalade.

Little description is needed of the autoclave method of softening peel. It is merely a question of determining the time required to soften a particular cut of peel in water at 15 to 18 lb. steam-pressure (rather than 10 to 15, as stated in the book). Naturally the coarser the peel, the longer this time will be. The autoclave should either be provided with a bottom-outlet large enough to allow both peel and liquid to run into a trough below, or the peel should be enclosed in a cage of non-corrodible metal, which can be lifted out and allowed to drain. The liquid will contain pectin and should be utilised for boiling the centres of the orange. It is also possible by connecting the autoclave with a suitable condenser and boiling at atmospheric pressure to collect a proportion of the oil of orange before finally closing and allowing the pressure to rise. Altogether a batch of coarse cut peel would probably not need to be in the autoclave for more than 50 to 55 minutes, which includes about 15 minutes for oil extraction, another 15 minutes rising to the maximum of 15 to 18 lb., about 5 to 10 minutes at the maximum, and 15 minutes falling again.

Picking Oranges in South Africa.

Ammonia is probably the best chemical softening agent, and the ammonia process can be carried out in pans of silver-lined copper, stainless steel or nickel as follows: Cover the peel (coarse cut) with water at the rate of about 90 lb. of peel to 20 gallons of water and boil for about ¼ hour, collecting the oil, if desired, by means of a hood connected with a condenser. Drain off the water, which will contain some pectin and can be used to boil with the centres of the orange. Fill up again with water to the same level and add ½ pint of ammonium hydroxide (specific gravity 0·900). The latter is bought in iron drums, which can be fitted either with a special tap or with a syphon provided with a tap, or, if preferred, it can be handled in more dilute form. After the addition of the ammonia the charge is just brought to the boil and the steam turned off. After standing in contact with the hot solution for about 10 minutes the peel will be soft. The liquid is then drained off and the colour of the peel restored by heating with an aqueous solution of about 2 oz. of citric or tartaric acid.

The process could, if desired, be made continuous on the following lines, thus obviating handling and breaking the peel into small fragments. The peel could be placed in suitable cages of non-corrodible metal constructed so as to open readily for removal of the contents, and large enough to hold the quantity required for one boiling of marmalade. These cages would first pass through a trough of either wood or non-corroding metal containing boiling water. This process would be timed to last ¼ hour for coarse cut peel, and the oil could be collected by means of a hood and condensers. The peel would then pass for 10 minutes through a trough containing weak ammonia maintained near the boiling temperature. Finally, it would be treated in a weak acid bath and finished under a spray of cold water. Inlets and overflows would be arranged for each trough so as to prevent the liquor in the first and third troughs from becoming too bitter and to maintain the correct strength of the ammonia solution in the second trough (*i.e.*, approximately ½ pint of ammonia and 20 gallons of water per 90 lb. of peel, as in the pan process). For finer cuts of peel or for shreds the heating periods will need to be shortened, both for the autoclave and for the ammonia process.

AGRICULTURE

and

CANNING

THE EDITOR,
FOOD MANUFACTURE,

DEAR SIR,

May I make the following comments which relate partly to your paper on "The Training of the Food Technologist" and partly to Mr. Samson's article in the April issue of FOOD MANUFACTURE?

As the production of the raw material, whether it be vegetables or fruit, is now playing such an important part in food manufacture and is becoming a highly specialised undertaking and, to my mind, will continue to do so more in the future, no food technologist would be complete without a fair working knowledge of both practical and scientific agriculture. This would be exceedingly difficult for him to accomplish and could only be done with a considerable amount of experience because, as you know, there are so many local conditions, apart from the factors of soil variations that can influence the quality and yield of product. Experience has shown that, whereas the production of certain crops (and here my remarks refer more particularly to vegetables than fruit, as I have not had much experience of the latter) on some types of soil has been quite satisfactory and up to a good standard for marketing requirements, results have varied considerably and in many instances have been quite unsuitable for manufacturing, particularly canning, purposes. Arising from this factor is the important feature of manuring, about which much has still to be learned, but undoubtedly with suitable application and in the right quantities it can greatly influence not only the yield but the quality of the ultimate crop. I do not wish you to infer that manuring alone can make a difference between a crop for manufacturing and marketing purposes, but I believe that in future it will play a more important part than it has done in the past. For instance, nitrogen may produce a luscious marketing fruit, but for manufacturers a firmer quality, possibly helped by more potash and less nitrogen, may be more desirable.

Picking Cherries.

It is undoubtedly becoming more and more important that the food manufacturer should be supplied with a constant and uniform supply of raw material, a necessity which calls for crops to be produced of a certain required specification, and while much is being done in this respect at the moment there is still tremendous scope for development. There will no doubt always be a variation in the quality of different firms' products, but I do believe that in many instances the development of the industry, particularly the canning section in this country, is prejudiced by the offering of low-grade quality packs. This question of quality can possibly be partly controlled by the manufacturer himself inside the factory, but perhaps the most important factor in the whole thing is the type of raw material he is handling. From my experience possibly one of the greatest difficulties that the manufacturer is up against is in procuring exactly what he wants, in convincing the producer that the specification of his requirements so often varies from that of production for the ordinary market channels. This feature is gradually being assimilated, but its full importance is not yet fully appreciated by many. Here the greater the co-ordination between producer and factory is encouraged the better will be the ultimate result.

Until recently the industry generally has been more or less dependent upon taking ordinary market varieties of seed for its crops, most of which can hardly be termed really suitable for this particular purpose. This fact is now becoming more thoroughly appreciated and, apart from the valuable work that certain agricultural research stations have done in the last few years, certain individuals in the seed business are making a serious study of this phase of the industry. Certain varieties are being introduced into this country which are modified in order that they will grow successfully in our climate. Other breeders are attempting to adapt, where necessary, in order to meet certain definite requirements. Personally, my own private opinion is that we are only on the fringe of development on this side of the industry.

Another point which has occurred to me is that of the harvesting and handling of any crop for food manufacture. We all know that there is always a right time when a crop should be gathered, but in order to get the best results I feel that this is a much more important feature with crops which are going to a factory. This condition of course varies with the type of stuff being handled, and to do it properly one would have to consider individual crops and varieties in detail. For instance, I am quite convinced that, in the case of peas, they should be picked shortly before they would be in what one would term the prime marketing condition.

With reference to your suggestion of the "factory farms", while in the main the principle is a sound one and a step in the right direction, I do not consider it to be absolutely practical, as undoubtedly certain crops can be produced in definite parts of the country to much better advantage than in others. It is of vital importance, however, that in order to achieve the best results the factory should be situated, so far as possible, within the area from which it takes the majority of its supplies, provided of course that the centre is an economic one for distribution of the finished article. Much has been done in the agricultural field, and much more will be done, but we must never forget the biggest uncontrollable factor—the weather.

One might say much more from the agricultural side, but, briefly, this is how I see the position in relation to the food technologist, and it occurs to me that, however efficient he may be, a good knowledge of agriculture in all its branches is absolutely vital for the success of his work. I personally feel that it would be somewhat difficult to combine the two duties—at any rate, to commence with—and it might be more advantageous for the food technologist to work in close collaboration with one who had had a thorough training in agriculture as applied to the production for food manufacture, as it is undoubtedly a very important side of the industry.

Yours sincerely,
A. IRVIN ROSE.

Huntingdon.
April 8, 1935.

THE TRAINING OF THE FOOD TECHNOLOGIST

By

H. B. Cronshaw, B.A., Ph.D., A.I.C.*

THE PROBLEM is simply one of devising a scheme of training which will be equally satisfactory for all students regardless of the particular section of the industry in which they may subsequently chance to find themselves, and, obviously, this is rendered fairly easy by the fact that the whole industrial structure rests on the same foundation of biology and chemistry.

One is dealing with yet another instance of the application of physical chemistry to a well-defined group of materials and to the peculiar processes to which they are subjected in practice. In this case chemistry is directed to a certain group of biological materials used for human nutrition, thus constituting a branch of biochemistry, in spite of what is still a tendency to limit the defined scope of biochemistry to "living organisms". Probably this is a survival of physiological-medical influences, but nowadays no one would deny the right to extend the scope of biochemistry to include the organism after death. Indeed it is just this dead organism (or, in some cases, one in which the life processes are slowed down, as in gas-stored apples) and the physical-chemical changes which take place in it that are the concern of the food technologist. In this respect he is in much the same position as the undertaker, whose interest in the body begins where that of the medical man ends. There is this difference, however; the undertaker's business is to expedite chemical change (provided the haste is not unseemly), whereas the food technologist's aim is to inhibit chemical change or, at any rate, to bring it under his control—as in fermentation. If it is true that one can obtain a B.U. (Batchelor of Undertaking) in America—which is presumably founded on chemistry, biology, bacteriology, and practice in deportment and decoration—this is yet another proof of the curiously Cinderella-like condition in which food technology finds itself.

It is therefore possible, in just the same way as has been done for metals, clay, glass, coal, petroleum, rubber, leather, and so forth, to devise a scheme of scientific and technical training which will provide the student with a broad foundation of knowledge enabling him to take up a potentially responsible position in any one of the many branches of the food industry and quickly to assimilate the details of practical routine.

The Scientific Study of Food Manufacture

Before actually coming to grips with the question as to what constitutes a suitable course of training for the food technologist, it is essential to examine the industry from the scientific standpoint in order to sort out the basic principles. Obviously the first requirement in this connection is some orderly scheme of classification for the main products which will throw into relief their physical-chemical relationships and correlate these with the various types of processes to which they are subjected during manufacture.

When an attempt at classification is made along these lines, one quickly realises that in the first place it can only be very imperfect owing to the diversity and complex nature of the products, particularly in the case of confectionery, and, in the second place, that there is a fundamental cleavage which sharply marks off all those products which are primarily derived from fruit, vegetables, meat, fish, milk and eggs, from those into whose composition sugar and flour (or cereals) enter as main ingredients. There is, furthermore, a fundamental difference in the character of the manufacturing processes to which they are subjected and the objects which these processes have in view.

This gives us two main groups:

Group 1. *Preserved Foods*, embracing preserved fruit, vegetables, meat, fish, milk and eggs, in their various forms. Products such as sauces, condiments, and mayonnaise may also be conveniently included in this group.

Group 2. *Bread and Confectionery*, embracing sugar confectionery or "sweets"; bread; and flour confectionery, such as buns, pastry, and cakes.

Preserved Foods

In the preservation of foodstuffs the primary object is to inhibit or to control selectively the biochemical changes which normally take place in the fresh, raw material so as to preserve it in a sound and palatable condition free from any undesirable effects of spoilage. These changes are brought about by the autolytic enzymes which are normally present in the material itself and by bacteria, yeasts and moulds which may be introduced into the material from outside sources. This object is achieved by the application of various processes, generally assisted by the incorporation in the material of substances such as salt, sugar, vinegar and spices, which, at the same time, bring about some modification of the original flavour. In certain cases a selective, rather than an indiscriminate, suppression of micro-organisms is aimed at, as, for example, in the preparation of sauerkraut or the curing of meats.

* *Continued from previous issue.*

TABLE I.—PRESERVED FOODS.

	Fruit.	*Vegetables.*	*Meat.*	*Fish.*	*Milk, Eggs.*
Drying	Dried fruits	Dried vegetables	Dried beef	Dried fish	Dried milk, dried eggs
Smoking	—	—	Bacon, hams, some sausage	Kippers, bloaters, finnan haddie	—
Salt curing	Brine cured fruits	Brine cured vegetables. Dill pickles, sauerkraut	Corned beef	Salted fish	—
Vinegar pickling or lactic fermentation	Pickled fruits	Sour pickles	Pickled tripe	Pickled herring	—
	Spiced fruits, chutneys, sauces	Sweet pickles, chutneys, sauces			
Sugaring	Wiesbaden fruits, jams, and marmalade. Glacé fruits, candied fruits, crystallised fruits	—	—	—	Sweetened condensed milk
Heat sterilisation	Canned and bottled fruits, pulps, and juices	Canned and bottled vegetables	Canned meats Pastes and meats in glass	Canned fish. Fish pastes	Canned cream
Cold storage	Chilled and frozen fruits	Chilled and frozen vegetables	Chilled and frozen meat	Chilled and frozen fish	Frozen eggs. Ice cream
Gas storage	CO_2 storage of fruits	—	CO_2 storage of meats and bacon	—	CO_2 storage of eggs

Table I outlines a system of classification which, however incomplete in detail, serves to bring some degree of law and order into the otherwise bewildering variety of preserved foodstuffs (there are some 300 varieties of canned products alone) by demonstrating that, starting with the five main groups of perishable raw materials, we have at our disposal eight (or nine if the chemical preservatives, sulphur dioxide and benzoic acid, are included) principal methods of preservation which may be applied to the majority of these materials. It is clear, therefore, that the logical method of approach is to familiarise oneself with (1) the structure, composition, and general biology of the raw materials involved; (2) the biochemical changes to which they are normally subject as the result of the activities of intracellular enzymes and those introduced from without by bacteria, yeasts, and moulds; and (3) the modifying effects of applying the main types of substances and processes to effect preservation and to combat spoilage. It is a case of chaining down the enemy within the gates and of fortifying against invasion from without. Obviously, if one is going to perform this task in an intelligent and scientific fashion it is absolutely essential to be well armed with a knowledge of the structure, composition, and other characteristics of the biological materials which are to be preserved intact, and to possess an intimate acquaintance with all the possible forces of destruction, as well as a high degree of skill in the effective application of this knowledge within the limits imposed by economic considerations.

Examination of Table I will show that the methods employed in practice to suppress, or to control selectively, the activities of micro-organisms (including enzymes) are:

(1) Application of relatively high or low temperatures, as in heat sterilisation and cold storage.

(2) Reduction in moisture content by (*a*) drying, or (*b*) osmotic replacement by solutions of salt or sugar (involving in some cases plasmolysis), as in salt curing and sugaring.

(3) Retardation of the natural ripening processes and the activities of micro-organisms in an artificial atmosphere containing less oxygen and more carbon dioxide than is present in normal air. This is referred to as "gas storage".

(4) Direct germicidal and antiseptic action induced by acetic acid, lactic acid, spices, formaldehyde, etc., from smoke, and, also, by sulphur dioxide and benzoic acid.

It will be noticed that in actual practice two or more of these methods may be combined. Moreover, a particular agent may operate in several ways; for instance, the action of salt depends on the type of organisms present and the nature of the material, and it has been stated that the action may proceed by (*a*) dehydration and plasmolysis, (*b*) direct effect of chlorine ions, (*c*) removal of oxygen, (*d*) sensitisation against carbon dioxide, and (*e*) inhibition of proteolytic enzymes.

The drying of fruit, vegetables, and similar foodstuffs does not differ essentially from that of other products in which moisture is initially distributed more or less uniformly through the mass. It is largely a matter of adjusting the temperature, relative humidity, air circula-

tion, and movement of the material itself at different stages of the drying operation so as to give the most rapid loss of moisture in conformity with whatever qualities in respect of texture, colour, flavour, etc., may be desired in the final product. Little has been done from a scientific point of view, although much experimental work has been carried out by Professor Cruess and his associates in California. In England similar work on the drying of vegetables was undertaken by Knapp during the war period. From a biological point of view the subject has been almost entirely neglected, although the problems are similar to those presented by freezing.

The film or spray drying of milk affords another set of problems, as also does the drying of blood, albumin, meat waste and fish products, and the vacuum drying of materials such as malt extract and eggs.

Although the smoking of meat and fish has been practised from the dawn of history, it has received little attention from biochemists and bacteriologists. Probably the most comprehensive studies (the German work is not readily accessible) are those of Hess in 1929 at the Halifax (N.B.) Station on the bactericidal action of smoke and by Griffiths and Lemon in 1934 at the U.S. Bureau of Fisheries' (Gloucester) laboratory on the smoking of haddock. Actually the process as practised is a combination of salting, surface drying, and smoking.

Work on the penetration of salt into fish and on associated problems is also scanty. Preliminary studies have been made by Bahr, Wille and others at Wesermünde, by Taylor of the U.S. Bureau of Fisheries, and by Carter at Nanaimo, but there remains a great territory virtually unexplored.

The scientific study of bacon curing is also in its infancy, although fundamental work of great value has lately been carried out by Dr. Callow of the Low Temperature Research Station, Cambridge. Reference should also be made to the investigations of Dr. Lewis and his associates at the American Institute of Meat Packers. The subject is of great complexity, but is essentially one involving principles of a physical, biochemical, and bacteriological nature.

Under Heat Sterilisation have been grouped the multitude of canned and bottled fruits, vegetables, meats, fish, and dairy products (even beer is canned) whose preservation is based on sterilisation by the application of heat and on protection from subsequent contamination by sealing in airtight and vacuumised containers. The basic principles involved are partly of a bio- and physico-chemical nature and partly of a bacteriological nature. The literature is abundant, but not easily accessible on account of the "closed" character of the research stations. This does not apply so much to the American institutions as to the British stations, whose reports, valuable as they are for the training of food technologists and embryo canners, are issued to a limited circle as confidential matter. The healthy development of the canning industry is absolutely dependent on an adequate supply of technologists particularly well qualified in physical chemistry, biochemistry, and bacteriology, and in the application of this basic knowledge to the problems peculiar to the industry. Consequently, any tendency on the part of the industry to restrain the free circulation of technical data among technologists and those who are in course of preparation for a technological career will have the effect of retarding the development of the industry to an extent which might easily be disastrous.

For an account of the work being carried out in connection with the storage of foodstuffs at low temperatures, or in atmospheres containing a certain proportion of carbon dioxide, one cannot do better than turn to the Annual Reports of the Food Investigation Board, from which it will be seen that here again physical chemistry, biochemistry, and bacteriology form the basic knowledge required of the investigator and also of the practising technologist. One might mention by way of illustration the influence of time and temperature on the freezing-storage-thawing cycle, the physics of the freezing of muscle and fat, fat rancidity, the biochemistry of rigor mortis, the denaturation of proteins, the resistance of refrigerated products to micro-organisms, the physiology of fruits and vegetables in cold storage, and so on. Linked up with this is a study of the changes induced by the rapid freezing of fish, fruits, meat, milk, etc., concerning which the American literature is voluminous, though not usually fundamental.

Likewise, the more recently developed practice of storing fruit, meats, and eggs in the presence of carbon dioxide and under controlled conditions of temperature and humidity is one which has been initiated and developed by scientific workers, notably at the Low Temperature Research Station at Cambridge. Here also may be included the storage of citrus fruits during transit in gas fungicides such as ammonia and nitrogen trichloride, and the use of ammonia in connection with the winter-storage of cabbage. Progress in this field, which may also be taken to embrace the converse practice of accelerating the ripening of certain fruits by the use of ethylene, is obviously dependent on the biochemist who defines the requirements which the engineer has to realise under commercial conditions.

The physical-chemical, as well as the bacteriological, study of ice-cream has not received the attention that it deserves. Curiously enough, the subject has been entirely overlooked by all the organised research bodies, in spite of the phenomenal growth of the British ice-cream industry during the past four years. The subject is big enough to warrant its own specialised research station.

The making of jams and marmalades is another neglected field which provides a great opportunity for extremely interesting work of a more or less fundamental character, in the light of which one will be enabled to examine a variety of manufacturing practices which have come to be blindly accepted without adequate reason. So far little or nothing of any scientific value has been published in spite of the many attractive problems which are presented by the subject and the important bearing which these have on practical considerations. There is, for instance, the unravelling of the factors which determine "set"; time, temperature, and manner of boiling; crystallisation; mould growth; flavour; fruit texture; pre-treatment; relative contents of the ingredients (including glucose and invert sugar); and so forth.

Closely allied in some respects is the preserving of

fruits in heavy syrups (Wiesbaden fruits) and the glacéing, candying, and crystallisation of fruits and citrus peels, in which the rate of penetration and the nature and extent of crystallisation as influenced by sugar concentration and its degree of inversion, temperature, fruit texture, pressure, etc., are the major subjects for study. Here again one finds plenty of literature giving bare, uninspiring accounts of somewhat involved manipulations, but nothing which treats the matter as a special problem of diffusion and crystallisation.

Pickles are in a slightly more fortunate position as a result of Dr. Fabian's researches at the Michigan State College, although his field was narrowed down to a particular type of cucumber pickles. Other bacteriologists, such as Le Fevre and Kossowiez, have also contributed much of value. Dr. Fabian concludes that the manufacture of pickles is a scientific process and their successful production demands a knowledge of fundamental principles. For example, the degree of salt concentration influences (1) the osmotic effect whereby juice is withdrawn from the vegetable, which influences its hardness, texture, etc., and furnishes food for bacterial growth, and (2) the nature and extent of the fermentation. Subsequently the acetic or lactic acid strength of the solution used for pickling has to be considered. The whole subject of pickles is, in fact, sadly neglected in spite of the interesting physical and bacteriological problems in which it abounds.

Pickles range by way of chutneys (relishes in America) to sauces, and in the preservation of these the acetic acid content plays an important part in conjunction with a variety of spices. A sauce considered as a colloidal suspension raises questions of stability as influenced by the degree of viscosity and dispersion. Much interesting work remains to be done by the colloid chemist on this and related questions. With the exception of tomato sauce and ketchups, the literature is extremely limited. In the case of mayonnaise and salad creams, which are emulsions of oil in vinegar, the literature is much more plentiful, and in this connection one calls to mind the work of Dr. Clayton and Dr. Corran.

(*To be continued.*)

OTHER OPINIONS

J. W. Corran, B.Sc., Ph.D., F.I.C., Chief Chemist, J. and J. Colman, Ltd.

"It is my firm opinion that the training of the food technologist should not in the main be fundamentally different from that of any other sort of technologist. It is true he needs more than a passing acquaintance with the applied sciences you mention, including bacteriology, biochemistry, biology, dietetics, etc.; but he needs something far more urgently than this knowledge, and that is versatility of mind and soundness of scientific and technical judgment. Otherwise the knowledge of the other sciences mentioned in your paper will tend to 'overflow'.

"To attain these two attributes—namely versatility or adaptability and soundness of judgment—a thorough training of the mind seems to me to be essential, and such training is found in present University curricula for scientific training, and the facilities for post-graduate research. It has often been said that much of the research now being carried out at the Universities has no obvious application to human affairs. This may or may not be so, but it has this virtue, it does train a man to think and act logically and creatively. If it does no more than this, it is of fundamental value as a training for a technologist of any description.

"Naturally, opinions vary as to the best kind of training for a scientific man. My own preference is for physical chemistry, including colloidal chemistry, embracing as it does the sciences and arts of physics and mathematics, as well as chemistry, and having its tentacles in the roots of biology, bacteriology, etc.

"When, and only when, a man has made himself capable of creative or ordered thoughts, can he add to his knowledge in the other applied sciences necessary for the food technologist.

"Therefore, although I believe with you that the wide training in the biological sciences is necessary, I put the fundamental mind training easily first.

"As for chemical engineering, it is of course necessary to have some knowledge of this, more particularly since the food technologist is generally intimately connected with processes; but a training in chemical engineering, like that in the other technical and scientific subjects, is an incident in his training.

"Finally, criticism has been voiced in regard to the manner in which scientifically trained men express themselves, and it has been suggested that a knowledge of Latin will help. So it will, undoubtedly, but it is my experience that it is generally the man who knows his subject best who can express himself most clearly."

A. W. Field, B.Sc., Production Manager, Alfred Bird and Sons, Ltd.

"The practical man producing food welcomes the searchlight Dr. Cronshaw has thrown on the training of the recruits he expects to receive into the food industry, and the thought and discussion provoked is welcome.

"In agreeing with the necessity for food technologists and a sound basic training, I do, however, doubt the value of any University training, pre-graduate or post-graduate, to help a student when, to quote Dr. Cronshaw, 'his intelligent co-operation is frequently required as, for instance, with the engineer, public health officer, advertising man, costing clerk, and in some cases the medical practitioner', or the many other commercial contacts he will inevitably have to make when he gets into industry. When stating the qualities an executive is expected to have, whether foreman or food technologist, theorists always include so many qualities as essential that it would take a superman to fill the rôle. Such qualities cannot be obtained by any course of study, but the common intelligence or individual character of the man and his catholic interests will do far more to help him in his industrial contacts. I state this as warning, as I think otherwise too much will be expected of the post-graduate University training.

"I do think, however, that in such a post-graduate course as is outlined emphasis should be made on the necessity for studying the commercial aspects of food production problems in order to train the student to anticipate criticisms of the various experts with whom he will come in contact.

"There is another subject which does not seem to have been mentioned and which surely should find some room in the syllabus. It is utility or the use of foods by the actual consumer. For, in spite of all the canned and prepared foods now sold, most foods have to be prepared at home, and it is absolutely essential that a food technologist should be able to understand not only the theory but the practice of cooking, and the suitability of foods for palate and convenience."

It is interesting to note that these views, coming as they do from one who is actually in the industry, run parallel with those expressed by Dr. Corran, who also speaks with the authority of first-hand experience.

H. G. Rees, Ph.D., A.R.C.S., D.I.C., A.I.C., Research Biochemist, Oxo Ltd.

"As lecturer in the Evening Course on the Chemistry of Foodstuffs at the Borough Polytechnic, to which you referred in your recent paper on the training of the food technologist, I am writing to give you some idea of the results of this 'experiment'. The course has now been running for many years and, judging from the results, it appears to have been helpful to the class of student for whom we cater. It is not an attempt to train the specialist, but rather to provide a general insight into the chemical nature of foodstuffs and the scientific principles employed in their manufacture for those engaged in the industry other than trained chemists. Naturally, it is not possible to consider more than the broad outlines in the time at our disposal and we can only hope that it will stimulate the student to further reading not only in his own but also in related fields.

"To give an example of the type of student interested, I might mention that the present class includes laboratory assistants from several of the larger manufacturers and distributors of foodstuffs, a meat inspector, a secondary school teacher and a dispenser from a child welfare clinic. As evidence that the course has been of some practical use, I can only state that some students from previous years are, like Oliver Twist, 'asking for more'."

I have now had an opportunity of discussing this matter with Dr. Rees personally and feel quite convinced that he is doing most excellent work at the Borough Polytechnic. It is certainly very desirable that the type of student to which he refers should have this opportunity of improving himself, and every encouragement should be given to place the course on an enlarged and permanent footing. The experiment might be repeated at other centres. Both Dr. Rees and Dr. Ingall, the Principal of the Polytechnic, are to be congratulated on having initiated a project which merits the unstinted support of the industry.

C. Taxner, Research Chemist, Royal Hungarian Food Research Station, Budapest.

"I agree with you on the point that the education of food technologists is a very much neglected field of technological education. It is obvious also that the food technologist ought to have a solid basis upon which his special knowledge should be built up. No doubt the fundamental knowledge of a food man cannot be complete without a very broad study in biology, biochemistry and bacteriology. In this respect I think University education is at present rather poor all over the world. Perhaps in America is strongest the tendency to improve biological education. There is an urgent need to do something towards improving the biological aspects in University education in Europe also. The further step in training food technologists is the provision of a post-graduate course for them.

"My suggestion is to establish several post-graduate courses for food technologists, each for the main lines of the food industry. Canning, preservation and pickling is one; the subjects comprised within the meat trades form another; baking, pastry, milling and sugar confectionery constitute a different branch, as do cold storage and other activities. All of these lines are quite different fields of food manufacture and they require their specialists. It is a very sound scheme to have a University pre-graduate course for the intending food technologist for the study of chemistry, biology, biochemistry, physics, mathematics, applied engineering, bacteriology, and the principles of food manufacture. After this course the student should be forced to gain some practical experience in the industry or in a research institution for one year and then complete his education by the specialised post-graduate course.

"There is one point in your paper that impressed me very much. That is the unity between education and research. This is of paramount importance. It is very difficult to teach without experience in research. One who does not carry out research in his particular subject is absolutely unable to teach that subject. The development in food manufacture is more rapid than in electricity, yet without research there would be no electricity at all. Shall we continue on the same pathway as that used by our grandmothers? Is a man able to teach internal diseases without a clinical practice? The only place in which to teach food manufacture is the research institute equipped with plant on at least a semi-commercial scale.

"There is another point of yours which is very important, and that is the publication of the results obtained by research work. It is nonsense to support by public money any work that is kept secret, even if it is partly subsidised by the trade. Real progress is only possible when the fullest publicity is given to the results of any research, particularly in food research. On the other hand, the publication of a popular account of the work is one of the best advertisements of the trade.

"In conclusion, I think it is the imperative duty of every food scientist to give the greatest publicity and attention to the question of improving the education of food technologists and research workers. That is brilliantly done in your lecture and therefore I contribute my heartiest congratulations to you. If at any time I shall be able to assist you in your great work I shall be very pleased."

SOME AMERICAN VIEWS

W. D. Bigelow, Director of Research Laboratories, National Canners Association, Washington, D.C.

"Although I read your article with interest, I hesitate to state my own views regarding this matter. I agree with you fully in your views of the training that is necessary to develop a technologist, but do not feel that there is such a person as a 'food technologist' in the sense that I feel that term should be used. Of course we have canning technologists, baking technologists, packing-house technologists, beer technologists, etc., and I can understand that one technologist might have considerable information regarding more than one class of food. However, the technological questions arising with various classes of foods differ from each other to such an extent that I do not believe that anybody can have such sweeping and widespread information that he is entitled to be called a 'food technologist'.

"I doubt whether a post-graduate course along such lines as you suggest is exactly what we want. It has been my experience that our greatest need is to get men who have broad fundamental information. I want this information to be broad and fundamental along scientific lines and would like to have it in food, chemistry, physics, mathematics, and biology. Training along such lines as this, which I believe to be important, requires so much time that I believe the full under-graduate and post-graduate study should be limited to cultural branches and fundamental instruction along such lines as those indicated above. I am perfectly willing to get men into the laboratory with such training as this, even though they have had no instruction whatever along applied lines.

"There is such a diversity of information called for in the different classes of foods that it sometimes seems that those classes have little in common. Moreover, in this laboratory it has been our experience that post-graduate training in metallurgy, ceramics, glass, fuels, and lubricating oil was of more value than in baking, confectionery, beer, or many other classes of foods."

C. H. Bailey, Professor of Agricultural Biochemistry, University of Minnesota.

"It is somewhat difficult for me to analyse at such long range the situation as it exists in England to-day, particularly in terms of the adjustments that would be necessitated in your institutions to conform to the ideals of your set-up. It is possible that certain of our American Universities have developed the technological equipment and courses of training more highly than has been the case in your country.

"In general I am in substantial agreement with you respecting the nature and breadth of the undergraduate training that should be afforded our budding food technologists. If we could identify these people definitely during the first year or two of their undergraduate course I would counsel the addition of a limited amount of training in the general field of chemical engineering. In this University, for example, several such courses are offered that would be useful to a man who was pointing himself for advanced work in this field. In this connection I have in mind particularly the desirability of ensuring that these men have a working knowledge of the applications, as well as the limitations, of mechanical appliances in the food factories.

"With our present social and economic systems it is always difficult to determine the exact future of these young men and women at the time they receive their Bachelor's degree. For example, one hesitates to point a man too highly for a specific occupation, realising that when his advanced work in this field is completed there may be no opening for him in the industry for which he has fitted himself. Several times in the past we have brought our young men through a course of training which really qualified them as the most expert in that particular field of specialisation to be found in this country, and yet in numerous such instances these men have ultimately found their life work in an entirely different field of activity. Fortunately, all of these men had a substantial background of fundamental training which enabled them to adapt themselves to other fields, but after such experiences one hesitates to groom a sizable group for special and restricted fields.

"Another feature of the situation which often embarrasses a University in this time is the cost of special equipment that might be desirable for affording special technological training. Such equipment is being improved at a rapid rate in this country, and if a University had a well-equipped food institute in miniature to-day it might find it hopelessly out of date five or ten years hence. In a few instances the industries have co-operated with the teaching institutions in providing special equipment that could be utilised in both research and advanced training. This is a very logical development and one that might well be expanded in many instances in the future.

"Since many of the larger factors in the food industries do not invariably reveal all of their practices to the public or to the instructional staff of the Universities, it necessarily follows that these details cannot be introduced into University or trade school instruction. For this reason I suspect that not infrequently the young man who has had thorough training in the fields of chemistry, physics, biology and engineering (the latter at least in some of its elementary aspects) can adapt himself readily to the new problems of the industries with which he may later become connected, and thus be of larger service than a man who has devoted too much time to a study of the pure technology of the industry in question.

"In America our larger industries are now becoming equipped with laboratories which can provide specialists in particular fields. I have in mind, for instance, the matter of mycology and bacteriology. It is well for the director of such a laboratory to have a working knowledge of this subject, but he is often provided with the services of a trained specialist who can actually lay out and carry through the detailed investigations in his particular field. The same is coming to be more or less true of the field of physics as well, where colour or thermal or electrical phenomena are involved. Thus one builds a well-rounded-out staff that can function in their respective fields of specialisation.

"May I indicate in closing that your paper gives evidence of careful thought and analysis. It serves as an excellent basis upon which to build a discussion of this subject. We evidently need a larger measure of co-operation between the educational institutions and the industries in developing this programme both in terms of subject matter content, and also in facilitating the placement of well-trained and competent technologists and scientists."

J. C. Marquardt, Associate in Research, Division of Dairying, New York State Agricultural Experiment Station, Geneva, N.Y.

"It is with pleasure that I comment upon your paper since it contains points of view which coincide with mine, and also because it was delivered before the Society of Chemical Industry.

"There is need for an institute that will train food technologists. Several worthy fragments of such an institute are to be found at Cornell, the University of Wisconsin, Stanford University, and at the University of California. There is also a demand for a place at which food technologists can be instructed while they are actively engaged in their profession. Something in the nature of graduate study while on leave of absence.

"In the United States there has been a tendency among industrialists to employ a food technologist only for a period of sufficient duration to obtain hastily the benefits of his experiences and training. This has given rise to the class who harbour 'new ideas, patentable material, etc.', mainly as a means of self-preservation.

"Well-trained men in food technology are available in our country. These men are usually employed by private industry or Government agencies. Their advancement in private industry is usually achieved as a result of their successes in the laboratory. The Government scientists, however, are frequently handicapped in their efforts by an involved system under which those who appeal to the administrative powers are advanced. The matter of achievement has been quite secondary under these conditions.

"In our country there has been a tendency at times to promote certain institutions, or certain men, for institutional or personal gain. Trivial as these affairs have been, they have had a bad influence upon those involved.

"I regret that I cannot comment further upon your paper. The limited views which are presented result from my observations over a period of twenty years. They have a radical tone; nevertheless, my personal experiences are not involved. The abuses referred to are seldom experienced in such institutions as our station.

"However, when the upper quartile is eliminated, my presentation is a fair one with conditions less favourable below the inter-quartile range than I have indicated."

Paul D. Watson, Assistant Chemist, U.S. Dept. Agriculture, Bureau of Dairy Industry, Washington, D.C.

"It occurs to me that my opinion on this subject would be hardly authoritative, inasmuch as I neither employ technical men nor have any connection with their training. I do think, however, the subject merits discussion, and that it might be feasible to establish such a post-graduate department in food technology at one of the centres of higher education in order to determine its possibilities."

George L. Baker, Assistant Chemist, University of Delaware Agricultural Experiment Station.

"Your paper, 'The Training of the Food Technologist', is interesting and timely. Any industry of the size of that which pertains to foods could well support more research into fundamentals and development and the translation of the results by trained technologists. Your suggestion of a post-graduate course for the training of the food technologist is a good one, but whether the industry would be willing to pay for this added training is questionable. It seems to me that under present economic circumstances, and as a start in the

right direction, the fourth year of the present University course might well allow for specialisation in food technology.

" Some of our companies have made a practice of employing research men with only an undergraduate training. If these men show exceptional aptitude for the work assigned to them, they are sent to some University for graduate study at the company's expense. If a post-graduate course were available in food technology, perhaps it would win the support of industry in some such manner. Food companies might be interested in sending men there for further training, and with such training a man would be more apt to note and translate research developments into his industry. It is quite noticeable that many research men are unable to make practical interpretation of their results.

" We were naturally interested in your comments in regard to the making of jams and marmalades. Several of the factors which you mentioned are being studied with jellies. Many of the factors in jelly making apply to jam and marmalade manufacture. From the letters which have come in since *The Canner* reprinted my article on ' Improved Methods of Jelly Making ', I find ' rule of thumb ' methods are generally used by small manufacturers in this country and many jelly failures result.

" I wish it were possible to discuss your paper with you conversationally. I want you to know that I approve of the outline and grouping of courses as you suggest them and hope some University will develop the idea."

B. W. Clarke, Food Technologist, Baltimore.

" I offer a few comments which may be of interest as illustrating the position of the food technologist in the U.S.A.

" I am fully in sympathy with your views as to the necessity for including training in biology, botany, and bacteriology, as well as chemistry in the education of a food technologist : those of us who drifted into the industry as chemists ' pure and simple ' will always regret our lack of early training in these fundamentals of the food industry. Furthermore, the chemistry courses usually offered at a University would be much more helpful to a prospective food chemist or technologist if more emphasis were placed on biochemistry, physical chemistry and particularly colloid chemistry (I am sure Dr. Clayton will heartily agree with this), than on inorganic or even organic chemistry. It seems to me that if those expecting to take a scientific course at a University were more aware of the opportunities offered by the food industry to graduates with a training in the subjects indicated, this would be a big step forward pending the organisation of special food technology courses of the type you advocate. Meanwhile post-graduate studies you recommend could very well be undertaken by suitably arranged night courses such as those of the Borough Polytechnic.

" I believe that by emphasising to the chemical profession in general, and to University Registrars in particular, the numerous openings occurring for food chemists or technologists in industry, and by offering employment to graduates who have had the fundamental training considered necessary, the food industry can go a long way towards eliminating the lack of training in the basic scientific principles of food manufacturing now complained of. It might be worth while to go still further and acquaint students in grammar schools, or equivalent institutions, of the opportunities offered by, and the training needed for, the technical side of the food industry.

" In the U.S.A. very few Universities offer courses in food chemistry, although more offer fairly thorough training in specialised branches, particularly in dairy products. However, a chemist who does find a foothold in the food industry in the U.S.A. has, I believe, more opportunities for qualifying as a food technologist—*i.e.*, one who bridges the gap between current research and its application to the food industries—than he does in England. In the first place, the agricultural Universities (at least, one University for each of the 48 states) engage quite vigorously in research activities dealing with the products of that particular state. The results of these researches are published in numerous bulletins, and, furthermore, the experiment stations are always eager to co-operate personally with any food manufacturer in their particular state who has any problem connected with the handling of any food product of that state.

" Then there are the manifold researches of the U.S. Dept. of Agriculture, which you mention—the bulletins describing these researches constitute a very valuable library of technical information for the food industry. Here again the Government scientists are very willing to give expert advice and active co-operation for any manufacturer who wishes to consult with them.

" Then we have the research laboratories connected with the various trade associations. To members of the association (that is, to those manufacturers who contribute financially to the support of the associations), very complete technical consultation is available in addition to the published bulletins which in themselves are valuable contributions to the literature of food technology.

" Probably of even more benefit to the average food manufacturer or canner, particularly in the ' preserved provision ' business, are the technical organisations of the suppliers of containers and equipment used in the industry. Suppliers of cans, glass and caps, used in varied lines of food preserving or canning, maintain well staffed and equipped laboratories. These laboratories offer the technologist (or would-be technologist) in the U.S.A. the opportunity of consultation and investigation on any problem connected with food packing in cans or glass, the suppliers of containers or equipment realising that the more the user knows about his products, the greater will be his demand for containers and equipment.

" Of course, contact of this kind is open to the objection that there is a risk of trade secrets being divulged or passed from hand to hand, but in actual practice it will be found that even if this risk exists, many so-called trade secrets, or secret processes, are standard trade practice anyway, and a food manufacturer who relies on some secret process or trick of the trade will not have such a reliable basis for his operations as a manufacturer who relies on proper selection of raw materials and scientific control of manufacturing processes for his reputation.

" With all these ' open ' sources of information, therefore, the pure and simple chemist in the U.S.A. has the opportunity to acquire some of the knowledge necessary to qualify as a technologist even if he is not in the desirable and enviable position of possessing a laboratory and technical staff which is able to investigate for itself all the manifold problems which confront him."

It is interesting to observe that all these contributors to the discussion are evidently thinking on much the same lines. They, in common with previous contributors, stress the necessity for a broad training in basic, scientific knowledge and methods. I had not realised that this view is so widely held, but it is one with which I most heartily agree. It would appear that the first effort in bringing about any measure of " reform " should be directed at the pre-graduate stage of education. It is beginning to look as though the final conclusion arrived at will be that the student, whether intended for the food or any other branch of industry, after a pre-graduate training in the broad principles of science, will be advised to take the first opportunity of passing into industry for a year or so for the purpose of gaining practical experience, and then, if considered advisable, he would return to the University or, better, to some similar institution (possibly a local technical institute would meet the requirements, as Mr. Clarke suggests), for a specialised post-graduate course. If this became the general rule, it would no doubt provide the simplest and most satisfactory solution to the problem and would leave the Universities free to confine their attention to the " pure " as distinct from the applied aspects of the sciences. But it would necessitate a fairly drastic remodelling of the present-day pre-graduate syllabus, and also a changed and more generous attitude on the part of industrialists.

It would be most helpful to have further views on these points.

"FOOD INDUSTRIES MANUAL"

"A TECHNICAL and Commercial Compendium on the manufacture, preserving, packing and storage of all food products" is the publishers' ambitious description of this Manual issued for 1935 in its fifth edition. Yet, it would be difficult to say that anything of importance has been omitted from this valuable reference book of the Food Industries.

Before opening the volume, which is again bound in the distinctive red cloth with gold lettering, the usual tabs marking each section tell you that it deals with Cereals, Confectionery, Meats, The Dairy Industry, Packages, and Cold Storage. But very much more is revealed by an examination of the Contents. Section 1, Cereals, for example, is fully comprehensive, covering Wheat, Milling, Flour, Baking and Flour Confectionery, about which there is a great variety of information upon such matters as Acidity of Flour and its Determination, Soya Flour, Analysis and Bacteriology of Flour and Wheat, Fumigation, Conveyors, Improvers and so on, to name only a few items at random. Compiled by an expert, this Section alone extends to 63 pages and contains many extremely useful tables and recipes.

The Packages Section is indispensable to everyone engaged in the manufacture of foodstuffs and deals with Packing Materials, Containers, and Packing Machinery. Cold Storage covers Refrigeration, Insulation, and Air Conditioning. Throughout all the sections there are a large number of illustrations of modern plant and equipment and many other reproductions of photographs, photomicrographs, drawings and diagrams appropriate to the technical matter, making the data sections characteristically complete.

The advertisements supporting this data are not arranged with each section, but in a separate group at the beginning of the Manual. They are informative and only very few are not illustrated. Many of them are exceedingly well designed, so that this section will be found very interesting to read by itself. Alphabetical and classified indexes of manufacturers and suppliers of Raw Materials, Products, Plant and Equipment enable immediate reference to be made to this section. Trade Names and Marks are also listed.

The volume is concluded with a Bibliography of nearly 100 pages of books that may be used in connection with the many branches of this greatest of all industrial groups. It would, however, be complete in every respect if a detailed index to the technical data sections could be added, though the make-up of the book is very simple and can be readily appreciated with a few minutes' perusal, so that information can be obtained quickly whenever desired.

Food Industries Manual is again edited by Dr. H. B. Cronshaw, assisted by well-known experts who have compiled the sections with which their names are associated. As a book of reference it is thoroughly up-to-date and should immediately displace the previous edition, which now becomes obsolete. At seven shillings and sixpence to subscribers to FOOD MANUFACTURE it is indeed modestly priced.

G. W. L.

Food Industries Manual, 1935. *Edited by H. B. Cronshaw, B.A. (Camb.), Ph.D. (Munich), A.I.C., assisted by six expert contributors. Issued by* FOOD MANUFACTURE. *Leonard Hill, Ltd., 17, Stratford Place, London, W.1. 219 pages Technical Data. 104 pages Advertisements. 99 pages Bibliography. Classified Indexes. Large Quarto. Price to subscribers to* FOOD MANUFACTURE, 7s. 6d. *Non-subscribers*, 10s.

THE COCKROACH PEST

IF conditions are really as described in the following extract from a recent letter to the *Observer*, it would seem that there is room for some publicity in connection with exterminating compositions:

". . . Though common in houses with basement kitchens, the greatest threat of cockroaches to health comes from their prevalence in immense numbers in bakeries, restaurant kitchens, hospitals, and similar institutions, and food factories of all kinds.

"It is no exaggeration to say that at least 95 per cent. of such establishments are overrun with one or other of the two varieties most frequently seen, the common cockroach (*Blatta orientalis*), often called in error the "black beetle", and the German cockroach (*Blatella germanicus*), or are only kept free by the strenuous efforts of the proprietors. Unfortunately for the public health, comparatively few of the traders concerned take any serious steps whatsoever to cope with the pest, with the consequence that little of the nation's bread and other prepared foods escapes contamination by this loathsome insect.

"It is true that the health laws call for an inspection by sanitary authorities of all premises where food is prepared for sale to the public, and it is within the power of such authorities to prosecute offenders, or even close up their premises in extreme cases, but the duty of inspection is carried out, more often than not, in a cursory manner, and at times when nothing is likely to be seen of the pest. It is common knowledge that cockroaches shun the light, yet rarely do such sanitary inspectors pay surprise calls when the premises are likely to be in darkness. It is then that a sudden turn of the electric switch is likely to disclose swarms of insects scurrying back to their holes or crevices to escape the light.

"Had the public any conception of the universality of cockroach infestation and the consequent danger of the carrying of dirt and disease of all kinds, an outcry would be raised loud enough to compel stricter supervision of all caterers' and bakers' establishments".

FOODS AS COLLOID SYSTEMS

"A PRACTICALLY virgin field for research awaits the colloid chemist who will devote his attention to oils and fats", declared Dr. William Clayton, in a paper which he read on "Foods as Colloid Systems" to the Liverpool Section of the Society of Chemical Industry a short time ago. Professor C. O. Bannister presided.

Dr. Clayton said that in no branch of technical chemistry was the incidence of colloid phenomena so prominent as in food chemistry, so he divided the subject into certain main themes because of their pronounced controversial interest, their special scientific significance or their exceptional opportunities for further research.

Stability factors amenable to experimentation, in the case of emulsoid sols, were the electric charge as controlled by the *p*H and the hydration factor as determined by the nature of the solvent used.

In general technical chemistry the outstanding feature regarding emulsions was the large number of patents dealing with the preparation of emulsifying agents. Most of these agents were developed along the lines of the modern conception of molecular orientation. In other words, the emulsifying agent was devised with the specific intention of its possessing some groupings attractive to water and some attractive to oil, so that the agent on absorption at the oil-water boundary was oriented and rendered the transition from one phase to the other less abrupt.

In his own laboratory they had succeeded in preparing compounds which had the striking capacity of totally inhibiting the deposition of stearin from chilled olive oil. Samples in the cold store had now stood for three years clear and fluid, whilst the controls set solid as soon as their temperature reached that of the cold store.

After commenting on the possibilities of research for the colloid chemist specialising in oils and fats, Dr. Clayton said he would find unexpected electrokinetic phenomena arising from the presence of polar groups. The cataphoresis of stearin in vegetable oils provided an example of this.

The denaturation of proteins was discussed in connection with the various food products, the nature of the proteins altering according to the presence of soluble or insoluble forms.

Industrial News

COLD STORAGE CHART—DEATH OF MR. FERDINAND BUSH—CANNERS' EXHIBITION, 1935—YET ANOTHER FOOD EXHIBITION—B.B.C. FOOD TALKS—CHEMICAL PLANT—A GLANDLESS VALVE—CARBONACEOUS DUST EXPLOSIONS

Cold Storage Chart

Few people realise that for each foodstuff there is a definite optimum temperature range for storing so as to ensure retention of the natural flavour and prevention of general deterioration; and, in addition, the part played by refrigeration in the manufacture of various products of everyday use is insufficiently realised.

Of great interest and value, therefore, is a special chart produced by Messrs. A. Gallenkamp and Co., Ltd., showing storage and transport temperatures for numerous foodstuffs and some applications of refrigeration to a number of industries.

The chart, which is based on a thermometric scale reading from −50° to 32° C. (marked also in Fahrenheit degrees, −60° to 90° F.), measures 25″ × 40″ and is very clearly readable. It shows the proper storage temperature for some 97 foodstuffs, and also the proper temperatures for the treatment of the various materials in the manufacturing processes related to some 26 industries.

Such diverse subjects as the quenching of ploughshares, cooling of turbo-alternators, storage of silkworm eggs, and rubber hardening are dealt with, but by far the largest part of the chart is concerned with the different food industries, which are treated very comprehensively. To pick only a few at random, information is given on storage temperatures for honey, bananas, venison, oysters, Camembert and 7 other cheeses, caviar, livers, liquid egg, margarine, etc., so it will readily be seen that the claim to comprehensiveness is not exaggerated.

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The important subject of distant indication and control—particularly in reference to water undertakings—is discussed in a publication recently received from Messrs. Evershed and Vignoles, Ltd., electrical instrument manufacturers.

The booklet is particularly valuable to water engineers. It deals with various systems of transmitting indication, indicating receivers, recorders and transmission lines, automatic pump control, etc.

Death of Mr. Ferdinand Bush.

We regret to announce the death at Bexhill on April 4 of Mr. Ferdinand Bush, a director of the well-known firm of W. J. Bush and Co., Ltd.

The youngest son of the founder of the firm (the late Mr. William Bush), Mr. Ferdinand Bush represented the company in Scotland from 1908 to 1916, when he returned to London on his appointment as general manager. Six years later he was elected to the board of directors, on which he continued to serve until the time of his death. Many of his acquaintances in all branches of the food industry will regret his passing at the comparatively early age of 59.

Canners' Exhibition, 1935

It has been decided to hold the next Canners' and Allied Trades Exhibition at the Greyfriars Hall, Cardiff, from October 25 to November 2 next.

This decision was arrived at after a number of other places suggested had been very carefully considered by the Executive Committee of the National Food Canning Council. In this connection visits were made to Liverpool, Leeds, and Glasgow, and the facilities which each of these places offered were thoroughly examined, but in each case the accommodation offered fell short of requirements. Liverpool may be the venue of a really first-class Canners' Exhibition in 1936.

Attention has also been given to the question of linking up the Canners' Exhibition with the Grocers' Exhibition at the Royal Agricultural Hall, as we suggested, but the idea has been dropped after careful investigation. Olympia has also been mentioned as another possibility, but it would take at least £12,000 to run the exhibition there, allowing only a moderate amount for publicity.

South Wales is known to be "canminded," and there is every indication that the people there will accord a very hearty welcome to the exhibition and will do everything that lies within their power to make it a huge success. Besides the general publicity that will be thus given to canned foods by the enthusiasts in South Wales, it is anticipated that the exhibition will have the beneficial effect of augmenting the local consumption. It will, in fact, crown with unqualified success the brilliant pioneering work which Sir Edgar Jones has carried out in that part of the country. This is bound to react favourably upon all sections of the British Isles. We congratulate the National Food Canning Council on the wisdom of their choice and on the thoroughness with which they have explored this difficult question of location.

Not only this, but the Council have

analysed in praiseworthy detail the circumstances which were responsible for the lack of public support on the occasion of the exhibition's second visit to Leicester. It seems clear from an examination of the results of this investigation that no blame can be attached to those who were responsible for the arrangements. Several contributing causes are accountable, among which may be mentioned the apathy of the local people to exhibitions in general—as evidenced by the failure of the Home Life Exhibition held in September—and the failure to get Royalty to open the show. Years of experience have shown that such an opening assures the largest measure of publicity and consequent interest.

A schedule of classes and prizes has already reached us, copies of which can be obtained from the Secretary, Imperial Fruit Show, Ltd., 5, Bloomsbury Square, London, W.C. 1. There are sections for Fresh Fruit, Canned Produce, Honey, and Preserves and Jams, the former being divided into United Kingdom, Empire, and Overseas Sections. Entries close on September 12 next subject to special arrangements for overseas entries.

Yet Another Food Exhibition

We seem to have had a regular spate of exhibitions of one sort or another just recently, but an exhibition covering the needs of the food industry is a "long-felt want" on Merseyside; accordingly, the announcement that the Liverpool National Food and Beverage Exhibition is to be held from April 30 to May 11 will please many in the North, and the exhibition is assured of good support. The venue is the Renshaw Hall, Renshaw Street, Liverpool.

Special features to attract and interest both the trade and the public will be incorporated, and the exhibition will be widely advertised. Buyers in the food, beverage, catering, and allied trades over a wide area will receive special invitations, with complimentary tickets, to visit the exhibition.

B.B.C.'s New Series of Food Talks

The B.B.C. has in the past broadcast a great deal of information on the subject of dietetics, both in its daytime and evening programmes, whilst many of the Friday talks on child welfare have dealt with the important subject of the right kind of food for the growing child. There has not, however, been a full-dress series of evening talks on nutrition since the spring of 1929, whilst the problems of a right dietary for various ages and circumstances in life has become increasingly important as the perplexities of the modern world increase. So it is good news that in the next programme which the Talks Branch of the B.B.C. has arranged there are to be eight talks on Food for Health, given by experts on the various aspects of the problem, who must, however, remain anonymous.

There are few of us whom the question of right food does not concern. The infant, the schoolchild, the young industrial worker, all need a balanced diet, so that a strong body may be built up from the start. The manual labourer, the active or the sedentary worker, the expectant and nursing mother, the unemployed man or woman, the middle-aged and the aged, all have special needs, and suitable food is one of the most important. So in this series of talks, which began on April 5, at 6.30 p.m., these and other problems of dietetics are discussed.

The first talk will be of an introductory nature, setting out just what the problem of nutrition is and the part that diet plays in this. The second talk on April 12 dealt with the diet of the child from one to five years, which is naturally a most important period of life, as in it the foundations are laid for good- or ill-health. Then on April 26 the question of the boy and girl at school was taken up, and this talk included a study of suitable food for children living in boarding-schools—a minor side of the problem, but one which is much discussed at the present moment.

In May further talks are concerned with the young industrial worker, the mother, and the adult worker, while the two last talks will be on the use and abuse of food, and the work which is being done to-day in laboratories all over the world.

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The fibre-board container has been a *fait accompli* for some time now, but sealing until recently still constituted a problem for the small- and medium-sized factory. Now, however, the problem is solved by Bird's Sealing Machine, made by John M. Henderson and Co., Ltd., of King's Works, Aberdeen, Scotland.

The machine is extremely simple to use: adhesive is applied to the top and bottom flaps of the container successively, when it is rolled to position under the platen of the press. It requires only one girl to operate it, handles 60 cases per hour, and occupies only 8 ft. × 2 ft. of floor space. The weight is 2 cwt. 3 qr.

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A machine which mixes, emulsifies, and homogenises at the same time is made by The Hunter Machines Co., Ltd. A special feature is the vortex which can be set up if it is desired to emulsify a liquid in another much heavier than itself, frequently a very difficult matter.

Equally successful has been its application to the solution of light powders, such as milk powder, resins, etc., in liquids.

Continuous circulation of the emulsion is one of the outstanding features of the machine, and is exclusive to the Hunter Emulsor. The standard model is made of copper heavily tinned inside, but it can be supplied in any special metal to deal with corrosive liquids, etc. A 2 h.p. motor is sufficient for a 10-gal. machine for emulsions of average viscosity.

Chemical Plant

Catalogue "B" of Messrs. Stockton Chemical Engineers and Riley Boilers, Ltd., gives information about a great variety of chemical plant manufactured by them, yet they emphasise in a foreword that they do not wish to offer only standard plant of rigid design, but rather to consider the special aspects of each particular manufacturing problem and to manufacture equipment to suit the requirements of individual clients.

Numerous boiling and stirring pans are described; jacketed pans have the inner pan of iron, steel, stainless steel, copper, aluminium, or Monel. Gas-heated pans are also supplied. Mixing and agitating machines are described and illustrated; one in particular, a spiral tube stirrer for liquids, is worthy of note, as it is stated to be excellent also for blending powders.

Evaporators of all types, pressure and vacuum, salting and non-salting, are described with a number of general applications, but it is again stressed that many other applications exist, and that suitable plant for special cases can be quoted for.

Another brand of this firm's work is distilling plant, and they are in a position to undertake the construction of specialised forms of stills for all purposes.

Several pages of this very comprehensive catalogue are devoted to oil extraction and refining plant, digesters and equipment for offal treatment, soap plant, and driers of all types.

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We have just received from Helsingfors a copy of the fifth edition of *The Finnish Timber and Paper Calendar*, 1934-1935.

Anyone interested in the subjects with which it deals will find in it a mass of well-classified information, in several languages, on exported woodworking products, stevedoring, the Finnish Industries' Central

A general view of the Central Laboratory of United Dairies, Ltd., at Wood Lane, London, opened by the Minister of Health on April 5, showing part of the extensive concreted space surrounding the building. Note the large expanse of windows to secure the maximum amount of daylight.

Laboratory, wood research work in Finland, the sawmills, plywood and spool, paper and wood pulp, contract forms, etc.

A Glandless Valve

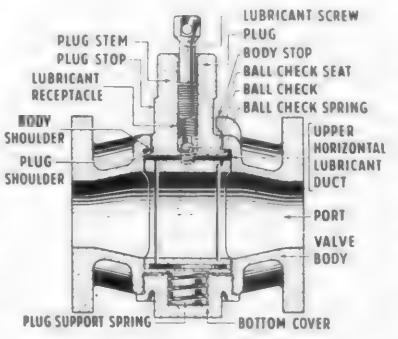
A very simple Lubricated Plug Valve is being manufactured by Messrs. Newman, Hender and Co., Ltd., Woodchester, Glos., who have appointed Messrs. Bell's Asbestos and Engineering Supplies, Ltd., of Bestobell Works, Slough, Bucks., as their stockists and service agents for this product in the British Isles.

After 5 years' successful service in handling petroleum products, steam, air, chemicals, foodstuffs, etc., it is claimed that the valve is free from the defects of either the gate, globe, or taper plug types, and possesses the following advantages:

- Elimination of all glands, gaskets, etc.
- Constant lubrication of only moving part and freedom from rusting and sticking.
- A cylindrical plug, instead of a taper plug, which has not to be raised from its seating to be rotated.
- Positive indication of full lubrication.
- Interchangeability of all parts.
- Minimum of head room required.

The valve is made in a variety of straight-through and threeway types, and from numerous metals and alloys to suit different services up to 3,000 lb. per square inch working pressure. Gear operation and indicators can be supplied when accurate control is necessary. A full range of lubricants is also available for different products handled up to a temperature limit of 500° F.

This type of valve is specially recommended for use in factories dealing with food products,



A sectional drawing of The Newman-Milliken Glandless Valve.

Carbonaceous Dust Explosions

A very interesting report has just been published by H.M. Stationery Office. In it Prof. R. V. Wheeler, D.Sc., gives the results of experiments into the means of preventing the spread of explosions of carbonaceous dusts.

Two particular lines were followed by the investigation: first, it was sought to ascertain how far worm conveyor choke tubes or rotary valves were capable of limiting the spread of a dust explosion, and, secondly, what precautions it was necessary to observe on a grain silo to ensure adequate release of pressure if an explosion occurred.

A table shows the relative explosibility of farinaceous dusts, and as a result of experiments carried out it is concluded that dangerous pressures can be developed within the tall, narrow silos commonly used for the storage of grain should abnormal circumstances lead to the ignition of a dust cloud in them. Under the conditions of the experiments (silo 7½′ diam. and 30′ high) adequate release of pressure was obtained by leaving the top one-third open, or but lightly covered.

The price of the report is 4d. (postage extra) and copies can be obtained from H.M. Stationery Office or any bookseller.

Highly-trained bacteriologists test samples of milk and other products at the New Laboratories of United Dairies, Ltd., Wood Lane, London. All laboratory workers wear white overalls. The clean design of the bench suites contrasts very favourably with the old-fashioned type.

INFORMATION and ADVICE

Mayonnaise—Worcestershire Sauce—Vinegar—Processed Peas—Tomatoes for Miners—Lemon Cheese—Lemon Curd—Jellied Fruits—Caramel—Rennet—Soluble Casein—Bottled Cream

Mayonnaise

1,840. *We have read with considerable interest your reply to questionnaire No.* 1,731, *which was put by us, in the December issue of* FOOD MANUFACTURE.

In the second paragraph you state that storage should take place at a uniform temperature of 60° *to* 70° *F., both as regards the oil and the finished product.*

The difficulty is, however, that the product in small stores, which are only heated during the day, cannot be kept under these conditions. Larger stores, which have their own outside warehouses, naturally warehouse their goods outside and bring them into the warm store as required.

It would appear, therefore, that this is one of the major troubles regarding mayonnaise separation. We have always been aware of this, and are looking for some way of overcoming it.

In reply to your questions in the last paragraph, please be advised that we do not use a homogeniser. Our method of manufacture is as follows:

First of all, we cook the base consisting of starch, salt, mustard, and water. Secondly, we add whole raw eggs, and start the mixer, running the oil in slowly until half the oil has been incorporated. At that time we stop the machine in order to refill the oil tank, after which the same process is continued until the batch is finished, with the exception that 50 *per cent. over-proof vinegar is added in order to keep the mixture at the proper consistency.*

The oil is all pumped direct from the barrels to the oil tanks, over the mixers, by electric pumps, through non-corrosive metal pipes and valves.

In regard to gum tragacanth, we have made experiments in the past with this, but as the result was, in our opinion, not desirable from point of view of consistency, we did not go any further into the matter. Do you think that this would give us a more reliable base than what we are using, as above?

Our mixer is a Hobart machine, using a wire whip.

We would appreciate your views on the above information, and would also like you to advise as to whether, in your opinion, it is possible to manufacture a mayonnaise which will stand up for a year or more under changing temperature conditions. (Canada.)

With regard to your enquiry, the details you have given are not sufficient to give an absolutely definite reply since you do not state whether your mayonnaise is strictly of the high oil type or whether it is in reality a salad dressing.

In the case of mayonnaise of the high oil type, containing, say, 65 per cent. or over of the oil, this product is practically universally prepared in the cold without the addition of artificial stabilising or thickening ingredients; in other words, the use of articles such as starch and gum tragacanth is dispensed with. In fact, in the case of a high oil content mayonnaise, it has been our experience that the addition of a slight amount of these stabilisers is not only of no significance but it tends very often to lower the freedom from separation of the product. If, therefore, the product is of a high oil content mayonnaise, similar to the American type, we would suggest that you use an ordinary whisk beater and first of all incorporate the dry ingredients—namely, salt, mustard, and raw eggs—with a third of the total aqueous phase, adding as little vinegar as possible before the oil (no doubt part of your aqueous addition is made in the form of water). This should be mixed for about 5 minutes and then the oil run in slowly. Then, when the thick nucleus has been prepared, the vinegar is finally added and is easily mixed.

If, however, it is really a salad dressing of which you are speaking, it is desirable to get the artificial ingredients, such as gum tragacanth or starch, in solution first. We think gum tragacanth is preferable to starch since it retains its consistency better. Then the egg, salt, and mustard should be added, followed by the oil and finally the vinegar. If this preparation contains sufficient egg there may be no need to use a homogeniser, but, generally speaking, it is desirable to put this product through a homogeniser, and, prior to doing so, it is the usual practice to heat it up to a pasteurising temperature. In the case of the American type of mayonnaise, however, homogenisation is not at the present time suitable.

With regard to the oil, it is best to buy winterised oil of a low acid value.

Salad creams properly processed and homogenised will keep on the market for a year or so, especially if they are suitably flavoured to mask the first onset of rancidity. This is not the case with American mayonnaise, however, which must be regarded as a fairly perishable article, and it is generally desirable to arrange distribution so that it will be off the market within three months of manufacture.

1,841. *You would oblige us very much by giving us directions for preparing mayonnaise sauce or any sauce of a nature similar to mayonnaise or salad dressing that is to be used on fish and will* stand sterilising *without being decomposed.* (Rotterdam.)

Our enquirer was supplied with a recipe.

Worcestershire Sauce

1,842. *We should be grateful if you could give us a recipe for Worcestershire sauce.* (England.)

We are afraid that it is not very satisfactory to quote a formula for this sauce, as so much depends on the choice of the ingredients and the correct method of manipulation. These two things are, of course, very largely a matter of practical experience. Furthermore,

there are dozens of different types of Worcestershire sauce, and, of course, the formulæ for the well-known brands are not disclosed. However, a formula by way of illustration is submitted.

1,843. *Referring to your December, 1934, issue, we shall be much obliged if you can send us a copy of your answer to Question 1,735 on page 447. (A method for preventing mould growth on tomato sauce was required.)* (Edinburgh.)

This was done.

Vinegar

1,844. *I am experimenting with gum tragacanth for sauce thickening and have been advised to steep it in water overnight. Kindly give me your guidance on this point.*

Also, I am bottling "Table Vinegar," and have heard that I must either put "Non-Brewed" and the address on the label to be in order with the law. Could you let me know if this is correct? (England.)

In making sauces it is usual to soak the gum overnight in vinegar or water. For instance, you could soak 2 lb. of gum overnight in 4 gal. of vinegar and the next day add two more gallons of the vinegar and stir well. If the recipe has both vinegar and water you could use water instead. The next day the gum is passed through a fine sieve into a pan which contains the rest of the ingredients, and then the whole lot is simmered for about half an hour, after which the contents of the pan are passed through a fine sieve and bottled. It is best to bottle it at over 180° F.

The spices are usually made into a thin paste with water and allowed to soak for 48 hours, and then added about the same time as the gum to the other ingredients in the pan.

As regards the vinegar question, the position is rather curious because by law one must obtain a vinegar manufacturer's licence. If you label it "non-brewed" you might be pulled up by the local authorities, especially in the North, who do not like acetic acid being put up as table vinegar instead of malt vinegar. On the other hand, if you do not label it "non-brewed" they might come down on you and caution you, and it would probably be a more severe caution than if you labelled it "non-brewed"; so it seems that in any case you are running some risk of the Public Health authorities saying something about it.

1,845. *I am interested especially in the production of vinegar. Those that are sold on the market are indicated with "20 per cent." or "10 per cent." Does the percentage mean the percentage of acetic acid in the solution of the product? Will you be kind enough to let me have all the necessary information for the manufacture of vinegar of "20 per cent." or "10 per cent."?* (Sumatra.)

We would refer you to the articles which appeared in the June and July, 1932, issues of this journal.

Processed Peas

1,846. *In an article in your previous number on processed peas you have suggested the use of citric acid in the covering liquid to hydrolyse some of the starch. We shall be glad if you could let us know, approximately, what quantity of citric acid to add per gallon of brine. We realise that the amount of citric acid must partially depend upon the amount of starch present, but we suggest in your answer that you should assume the peas to be fairly starchy.* (England.)

With regard to the quantity of citric acid to be added to the brine, 2 oz. of solid citric acid is usually added. This may be increased slightly if desired, but it is getting near the limit when an acid taste becomes noticeable. We should like to add that, although the addition of acid reduces the tendency of processed peas to jelly in the can, this trouble is really best overcome by increasing the proportion of brine to peas. This has the effect of reducing the concentration of starch in the final liquor, thus retarding jelly formation. Acid in the proportion mentioned above may still be added with advantage.

Tomatoes for Miners

1,847. *I am a subscriber to your publication* FOOD MANUFACTURE, *and on this account I permit myself to request some information from you.*

I understand that the proprietors of coal mines in England provide peeled tomatoes as well as tomato juice free or at cost price. It appears that this is indispensable for the health of this class of workers.

It appears also that the rest of the English public has followed this example and that it consumes, throughout the whole country, an enormous quantity of tomatoes and tomato juice, both in respect of adults and children.

I am the agent of a large Californian firm, and of a Canadian firm also; my works produce peeled tomatoes as well as tomato juice. Could you tell me the reasons why these tomatoes and this juice are consumed?

It seems to us that here also, in a country rich in coal, the same reasons could certainly be invoked for consuming tomato.

In order to be able to base my publicity on sound reasons, I shall be very much beholden to you if you could provide me with this information. (Belgium.)

We can't think why coal miners should have to depend on tomatoes for their complete health, unless it is that their occupation away from the benefits of sunlight makes it desirable that whatever deficiencies result from this occupation should be made good by the particular combination of vitamins found in tomatoes.

On putting the conundrum to the Mines Department we received the following: "I am directed by the Secretary for Mines to say that he has no knowledge of either peeled tomatoes or tomato juice being supplied to coal miners in this country".

Perhaps there is a lot of secret tomato juice drinking going on in our coal mines! The question should be raised in Parliament.

Lemon Cheese

1,848. *We have complaints of our No. 2 quality lemon cheese cracking and would like to know how to avoid this. The recipes are as follows: ——.* (London.)

Judging from your recipes above, and without seeing the product or knowing the method you adopt in manufacture, there appears to be nothing to criticise.

Possibly the cause of the cracking is filling too hot. The cheese should not be filled above 200° F.

However, in order to be able to speak with more certainty, it would be necessary to let us know something about your methods of manufacture.

Lemon Curd

1,849. *Will you kindly inform us as to the difference in the definitions of Lemon Cheese and Lemon Curd?* (Lancashire.)

Harris and Borella in *All About Pastries*, 1906, state that "Lemon curd is not a curd at all, it really belongs to the honourable order of 'custards'. It is, however, generally known as lemon curd because it is used to make what are again miscalled lemon cheesecakes." This statement appears to summarise the situation completely. Originally small tarts or pies were made with a cheese filling, which was later varied by the use of other mixtures, a popular variety of which was called "Lemon Cheese Curd" or for short "Lemon Curd" in this country, and "Lemon Butter," a better description, in America. It would appear that it was formerly the custom to bake the mixture in the pie, and a typical recipe for such a filling is:

Butter	4 oz.
Sugar	6 ,,
Cornflour	1 ,,
Milk	1 pint
Yolks of eggs	4
Lemons	4

which is in direct conflict with some of our modern purists, who claim that lemon curd should only be made from sugar, butter, lemon, and eggs, though, even some forty years ago, it was the custom only to employ these ingredients for what was known as cold filling. It is probably on account of the combined use of milk and lemon that the preparation was known as "Lemon Curd". According to the *Modern Baker and Confectioner*, small pies should be called lemon cheese cakes, but sponge rolls, etc., where curd is employed instead of jam, should be described as curd rolls, etc.

1,850. *Will you be so kind as to give me such information as you have on the subject of how to make marmalade with rum in it?* (New York City.)

We have been making enquiries, but have not come across any marmalade in this country which contains rum. Your best plan would be to get in touch with Professor Cruess of the University of California, Berkeley, Cal.

1,851. *I am thinking of manufacturing a preserve containing lemon juice and apple. The ingredients, after being cooked, are to be pulped. What kind of sieve should be used so as to avoid metallic contamination?* (Bristol.)

We would suggest that stainless steel and Monel metal would be suitable for the purpose you have in mind, and possibly aluminium, and would suggest, if you are interested, that you communicate with the firms named in our letter.

1,852. *Have you any general instruction or definite schedules for canning fruit, vegetables, etc., such as might be required and asked for by people who were considering starting a canning business?* (London.)

We would first of all suggest that you refer to the canning section of the *Food Industries Manual*, which should give you a good idea of the subject. If after reading this you require information on any specific point we shall, of course, be only too pleased to do what we can to help you.

Jellied Fruits

1,853. *Kindly furnish some information on the manufacture of jellied fruits such as raspberries, strawberries, orange and lemon slices, which are sold at Christmas time.* (England.)

Possibly the following notes may be of some assistance:

Raspberries, strawberries, cherries, etc., are made from a stiff fondant cream or 50 lb. of white sugar, 3 gal. of water, 10 lb. of 40 glucose, colour, acid, and flavouring. The water and sugar are put in a pan and brought to the boil, and then the glucose is added, and all boiled to 240° F. A cover must be kept on the pan all the time it is boiling, and it is then poured on a slab and allowed to set (but not to get cold), and then put into a creaming machine and creamed until about to set, when it is turned out into a hand pan and a clean damp cloth placed on the top. It is allowed to set and get quite cold and hard. Then it is put in a hand ladle, which is immersed in hot water, and when the cream is melted it is coloured and flavoured, and poured into moulds, and allowed to set quite cold. The pieces are then taken out of the moulds, and the imitation stalk put on by hand with a little gum, and they are finished by hand painting with coloured syrups. The figs are made with the agar-agar mixture with some fig pulp added. The fig pulp is made as follows: Some dried figs are well washed and drained; then put in a steam pan and allowed to simmer with enough water to cover them until quite soft. They are passed through a fine sieve. The pulp must be thick and not contain too much water. About 10 lb. is used to each 56 lb. of the agar-agar mixture and coloured with a little caramel. The orange and lemon slices are made from the agar-agar mixture and a cream lozenge paste. A cream lozenge paste is one made with fine icing sugar and glucose, mixed and rolled into sheets. The centre of the orange or lemon is made from the agar-agar recipe and poured into bowl-shaped tin moulds and allowed to set; then they are taken out and the imitation skin put on the round side and allowed to set hard. They are then painted with a coloured syrup by hand and set to dry. Then they are cut into slices by a fine cutting machine and stood until quite hard and dry. Finally they may be put into crystallising pans containing cold syrups.

Caramel

1,854. *Will you please give formula for the manufacture of an intense caramel having a colour tint of 50,000 Lovibond, and also one for the manufacture of yeast extract?* (Australia.)

As regards the manufacture of caramel, we rather think that you will find it waste of time to attempt to under-

take the manufacture of this product, as it is one which calls for very great skill, and undoubtedly for previous experience. The difficulty, of course, is to regulate the process so that the product shall be of a standard uniform colour.

By far your best plan is to purchase the material from a reputable firm that operates on a large scale, and get a guarantee that their product will always be up to a certain standard of colour tint.

If, however, you are seriously interested in the manufacture of this product, before any help could be given, we should have to have detailed particulars of your requirements, such as intended output, amount of money to be spent on plant, and so forth.

Your best plan would be to put up the proposition to a chemical engineer who is familiar with this kind of work and get him to give you a complete specification.

As regards yeast extract, we had an article on this subject in the October, 1932, issue of our associated journal *The Manufacturing Chemist*, and we should be very glad to let you have a copy if you do not possess one.

Rennet

1,855. *We anticipate the manufacture of rennet tablets and we understand that Holland is the best country from which to get rennin. We would esteem it a favour if you would kindly give us the name of some manufacturers of rennin tablets and essence, and at the same time you will be doing us a good turn if you can give us the name of rennin manufacturers.* (Australia.)

In our experience Holland is not looked upon as a large producer of rennet for export. As a matter of fact, we do not know of one Dutch firm whose product is sold in this country. Rather is it the case that the reliable firms in this country possess a good reputation with regard to their liquid and solid rennet products.

The manufacture of *rennin* is never carried out for dairy work and, except for biochemical work where the actions of pepsin must be ruled out in studying rennin action, we do not think that any attempt is made to destroy pepsin in commercial rennet preparations.

Soluble Casein

1,856. *Kindly give us some information on "soluble casein".* (South Africa.)

Soluble casein is the mono-sodium salt of casein. Ordinary commercial casein—*e.g.*, that prepared by the grain-curd process—is treated with dilute caustic soda solution so that the ratio of casein : caustic soda (NaOH) is 100 : 1.

The well-mixed mass is well stirred, dried, and pulverised. We do not know the exact method of preparing the material of commerce, but the above quantities are correct. The dried product is more fluffy than the original casein and wets very easily with water. The B.D.H. "Light White Casein" is an example of a soluble casein. The material is not strictly soluble, but a milky emulsion is formed which can be coagulated by acid. Too high a temperature during the drying process must be avoided, as above 40° C. some hydrolysis of the casein takes place.

1,857. *If I make up for the use of the bakery trade a liquid containing, say, 10 per cent. cocoa pure, with added colour and flavour, am I entitled to call this "chocolate colour and flavour", without being liable to prosecution for a false label?* (Middlesex.)

In our opinion, which should not be taken as in any way official, it would seem to be quite all right to label the product as you suggest, provided it contains about 10 per cent. cocoa.

1,858. *We are considering the possibilities of manufacturing waxed airtight cartons and similar packages, and wish to get into touch with firms who supply machinery for making up and waxing such packages, and who are in a position to advise us in the matter.* (Carlisle.)

Our enquirer was put in touch with two firms likely to be able to give the required information.

Bottled Cream

1,859. *Please give information on the bottling or canning of sterilised cream.* (England.)

With regard to your enquiry on the subject of sterilising cream, we are afraid that we cannot give you full details of the process as that is really a job for a firm of engineers or a consultant.

In general terms it involves preheating, homogenisation, and sterilising. Preheating is an important process, as it appears that certain physical changes effecting coagulation should take place before the process of homogenisation. The preheating temperature recommended is generally 70° to 80° C.

The homogenisation is carried out by the ordinary type of machine, and if you apply to the makers they will give you a good deal of information on the whole question of cream treatment for bottling or canning.

The temperature at which sterilisation is carried out is usually recommended as from 220° to 275° F. It is generally agreed, however, that a temperature of 245° F. must not be exceeded, as otherwise there is the danger of getting a burnt taste, and the temperature also influences the whipping properties. The time of sterilisation will, of course, be dependent on the size and type of the container and will have to be determined experimentally.

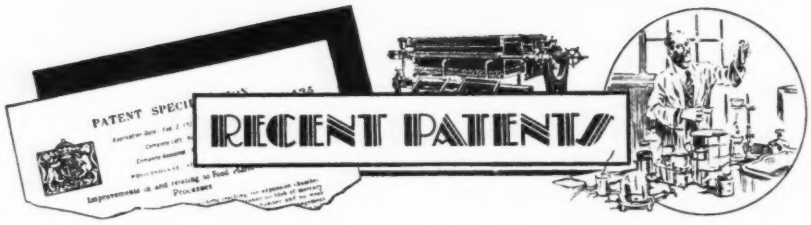
One might also mention that the pressure of homogenisation influences the whipping properties.

It is necessary to exercise very great care in seeing that the bottles and caps are perfectly clean. It is better to line the caps with parchment or special cardboard, rather than composition cork, as this sometimes blackens.

There is nothing added to cream to act as a preservative. It appears, however, that in order to stabilise against what is known as thermo-coagulation, about 0·025 to 0·1 per cent. of sodium citrate, phosphate, or carbonate is sometimes added.

The process should not differ very much from the canning of cream, in which for the ordinary size cans sterilisation is usually carried out at 240° F. for 20 minutes. The cream is filled into cans hot after pasteurisation.

The Danish practice is to load a cage trolley and push it into a retort in which the trolley is rotated at about nine times a minute.



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Latest Patent Applications

6713. SANCHEZ, P.: Treating sugar. March 4. (United States, April 9, 1934.)
6915. INDUSTRIAL PATENTS CORPORATION. Treatment of foodstuffs. March 5. (United States, September 20, 1934.)
6919. INDUSTRIAL PATENTS CORPORATION. Treatment of foodstuffs. March 5. (United States, November 30, 1934.)
6948. MAY, J. W.: Conditioning beverages. March 5.
6957. MACILWAINE, A. W.: Preservation, etc., of copra. March 5.
8353. SOC. D'ÉTUDES ET APPLICATIONS INDUSTRIELLES: Treatment of milk products. March 18. (Switzerland, November 14, 1934.)
8453. GES. ZUR VERWERTUNG FAUTH'SCHER PATENTE: Manufacture of edible oils, etc. (Germany, April 10, 1934.)
8689. HOFFMANN-LA ROCHE AND CO. AKT.-GES., F.: Process for vitaminising foods. March 20. (Switzerland, April 18, 1934.)
8728. EBNER, O.: Production of extracts from coffee, etc. March 20. (Switzerland, January 26.)
8742. CALIFORNIA FRUIT GROWERS' EXCHANGE: Treating pectin. March 20.

Complete Specifications Accepted

425,567. ALLEN, H. E., and MCCALEB, A. G.: Method and material for coloration and condimentation of foodstuffs.
425,853. LOOSE-WILES BISCUIT CO.: Method of making cereal food products and the article made thereby.
425,863. BECK, A.: Processes and apparatus for refining of chocolate masses and similar masses.
425,905. BRAMIGK AND CO., LTD. (GERNHARDT, B.): Process and apparatus for the glazing of fruits.

Printed copies of the full Published Specifications may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C. 2, at the uniform price of 1s. each.

Abstracts of Recent Specifications

Group Abridgments can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C. 2, either sheet by sheet as issued on payment of a subscription of 5s. per Group Volume, or in bound volumes price 25s. each.

423,063. **Milk powder manufacture.** N. M. KRONBERG, Rydsgard Castle, Rydsgard, Sweden.
This is a modification of a prior patent (E.P. 405,192), in which the following process was specified: After heating skimmed milk to above 100° C. it is cooled to about 35° C. and then treated with a pure culture of lactic acid bacteria prior to homogenisation while cooling to 18° C. The milk sugar originally present is transformed into lactic acid. Another batch of skimmed or full cream milk is also homogenised and incorporated at about 250° C. with milk sugar and liquid vegetable fat or (when using full cream milk) with milk sugar alone. The two homogenised batches are then sprayed into a common drying chamber (kept at 80° C.), using a larger quantity of the last-mentioned homogenised milk.

The essential modification employed in the present patent is the substitution of a pure edible organic acid for the lactic acid bacteria either before or during the preliminary heating stage, with a view to inversion of the milk sugar to dextrose and lævulose. The modified process can also be used to produce sweetened milk powder by dissolving sucrose in water or whey after adding sufficient organic acid to bring about inversion and heating to the requisite temperature. The inverted solution is then blended with the milk used for producing the milk powder. (Convention date not granted.)

423,603. **Fat-poor stable press cake from clupeidæ.** GODAL, A., and OVSTHUS, A., both of Flesland, near Bergen, Norway.
Production of press fish cake from herring and other fish of the clupeidæ family with a fat content of less than 6 per cent. as compared with 8 per cent. in normal press fish cake is based according to the present process upon dehydration of the raw fish *in vacuo* at a temperature below 70° C. until less than 20 per cent. water is present (calculated upon the finished pressed product), followed by expression in hydraulic presses of the type used for pressing vegetable oil-bearing beans, seeds, and nuts at a pressure gradually increasing from 50 to 250 kgm. per sq. cm. Such a low fat content is not obtainable by the customary process whereby the fish is cooked or heated to the temperature of boiling water either before or during dehydration. On the manufacturing scale fresh herring, for example, is pulped in a suitable disintegrating and grinding plant before pumping to a vacuum-dehydrating apparatus where a temperature not exceeding 55° C. is employed to reduce the water content to 12 to 15 per cent. At this low temperature no injury is suffered by the vitamins, proteins, and phosphatides. The final fat-poor cake, which is fit both for animal and human consumption, is obtained by then expressing, as mentioned above, in a hydraulic press under a pressure increasing from 50 to 250 kgm. per sq. cm.

423,971. **Bleaching agents from enzymic oxidation of fatty matter.** J. R. SHORT MILLING CO., corner of 38th and Wall Streets, Chicago, Illinois, U.S.A.
Products obtained by oxidation of fatty materials in the presence of enzymes are here specified as highly efficient bleaching agents for dough, oils, fat, waxes, and food products in general. Soya bean meal, for example, is stated to be a convenient catalyst in enzyme oxidation of fats in this connection. It is prepared in a suitable form by washing "enzyme-active" whole soya beans and soaking them in two to three times the weight of ice-cold water for sixteen hours or longer prior to fine-grinding and immersion in cold water (2,000 soya product to 6,500 water). After a few minutes the liquid is pressed out, leaving a milky extract. The latter is stirred up with 20 parts calcium chloride in water, allowed to settle, and the supernatant liquid decanted off. In illustrating the process as applied to cotton seed oil, an example specifies thorough aeration of 300 parts partly hydrogenated cotton seed oil in admixture with a suspension of 90 parts "active" soya flour, prepared on the lines indicated above, in 3,600 water. This is preferably effected by beating for four hours at 50° C. The fatty material is subsequently separated by centrifuging or solvent extraction. The increase in oxidising activity of the so-treated oil is represented in terms of the so-called M-value, M being the number of gram molecules of hydrogen peroxide per 1,000 gm. fatty matter. In the above example the hydrogenated cotton seed oil at the outset possessed an M-value of 0·0095, whereas the activated material is stated to possess an M-value of 0·1670.

424,234. **Beverage cubes.** BAUR, J., the Sugar Factory and Refinery, Modřany, Czecho-Slovakia.
Readily soluble cubes for preparing beverages such as tea, coffee, cocoa and fruit drinks are based upon hollow moulds of pure sugar, in the hollow of which the beverage-producing product is placed. These moulds are prepared in the usual manner by drying compressed moistened sugar powder. *Examples:*

1. *Tea cube.* Into a sugar mould of refined sugar measuring 45 by 45 by 15 mm. and weighing 33 gm. with a circular hollow measurement of 32 mm. diameter and 8 mm. deep are placed 2 gm. of tea.
2. *Tea-rum cube.* A mould of the same size as used in the preceding example, but with a larger hollow opening, is filled with 2 gm. of tea and a liqueur ball containing 4 gm. of rum.
3. *Raspberry drink.* A 25-gm. hollow mould measuring 45 by 45 by 10 mm. is filled with a sugar drop containing 5 gm. raspberry essence.
4. *Lemon drink.* A mould weighing 25 gm. is filled with 1 gm. citric acid and a liqueur ball containing 5 gm. of a solution of lemon juice oil.

In each case a cube is formed by superimposing a corresponding hollow mould upon the filled half, and the whole kept in a fresh condition by wrapping in a transparent foil or the like. (Convention date, Czecho-Slovakia, January 30, 1933.)

RECENT TRADE MARKS

This list of Trade Marks of interest to readers has been selected from the "Official Trade Marks Journal", and is published by permission of the Controller of H.M. Stationery Office. The "Trade Marks Journal" can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C. 2, price 1s. weekly (annual subscription £2 10s.).

ALLADIN.—558,118. **Dried fruits and canned fruits.** FIELD AND COMPANY FRUIT MERCHANTS, LTD., Turban House, 3, Eastcheap, London, E.C. 3. April 3. (Associated.)

B. & G.—B 548,785. **Fresh fruits, fresh vegetables (for food), and dates.** The firm trading as BROOME AND GREEN, 27, James Street, Covent Garden Market, London, W.C. 2. March 20.

User claimed from April 2, 1928.

CANABEC.—558,006. **Cheese and cheese products (for food), milk, cream, condensed, sterilised and evaporated milk (for food), butter, and butter and milk products (for food).** CHATEAU CHEESE CO., LTD., 18 to 20, York Street, City of Ottawa, Dominion of Canada. March 20.

CIVIC. — 557,382. **Sauce, pickles, and gravy browning.** DAVID JONES AND CO., LTD., 33, Redcross Street, Liverpool. March 20.

The above-mentioned goods and goods of a like kind will be struck out from the goods of Registration No. 326,538 (1703) if and before the applicants' mark is registered.

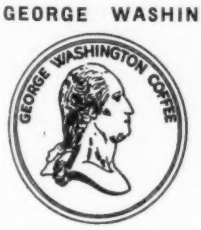
DEWLANDS.—557,609. **Substances used as food or as ingredients in food.** LIPTON, LTD., 179 to 189, City Road, London, E.C. 1. March 20. (By Consent.)

E. D. B.—558,128. **Substances used as food or as ingredients in food.** ELIAHOO DAVID BEKHOR, Haji Rais Buildings, Riverfront Road, Mohammerah, Persia. April 3.

F. M. S.—555,403. **Substances used as food or as ingredients in food.** THE FARMERS' MARKETING AND SUPPLY CO., LTD., 59, Mark Lane, London, E.C. 3. March 20.

Registration of this trade mark shall give no right to the exclusive use, either separately or in combination, of the wheatsheaf and milk churn devices.

GEORGE WASHINGTON COFFEE.—556,981. **Coffee.** G. WASHINGTON COFFEE REFINING CO., 104, Hanover Avenue, Morris Plains, State of New Jersey, United States of America. March 27.



GOLDEN SUN. — 554,453. **Condensed milk and milk powder (for food).** LIJEMPF (LEEUWARDER IJS EN MELK PRODUCTEN FABRIEKEN) NAAMLOOZE VENNOOTSCHAP, Potmdrge, Leeuwarden, The Netherlands. April 10. (By Consent.)

HIJĀT.—556,629. **Tea.** HIJĀT TEA CO., LTD., 19, Tottenham Street, London, W. 1. March 20. (Associated.)

Registration of this trade mark shall give no right to the exclusive use of the container device.

HIJĀT.—556,630. **Tea, coffee, and flavourings (not alcoholic) for foods and beverages.** HIJĀT TEA CO., LTD., 19, Tottenham Street, London, W. 1. March 20. (Associated.)

Registration of this trade mark shall give no right to the exclusive use of the device of tea leaves.

KELLOGG'S ALL-BRAN. — B 552,409. **Preparations of bran for use as food.** KELLOGG COMPANY OF GREAT BRITAIN, LTD., Bush House, Aldwych, London, W.C. 2. April 10.

User claimed from February 28, 1922.

The applicants undertake that this mark, when registered, and the marks Nos. 552,122 (2971), 552,408 (2969), and 552,557 (not yet advertised) shall be assigned or transmitted only as a whole and not separately.

Registrations Nos. 372,790 (2039), 376,300 (2039), and B 458,353 (2522) will be cancelled if and before the applicants' mark is registered.

MAGGI'S GRANULATED BOUILLON.—556,518. **Soups.** FABRIK VON MAGGI'S NAHRUNGSMITTELN, also trading as the Maggi Co., Kempttal, near Winterthur, Canton of Zurich, Switzerland. April 10. (Associated.)

The applicants undertake not to use the cross device in red, or in white on a red ground, or in any similar colour or colours.

MAGGI'S SEASONING.—556,517. **Seasoning for food.** FABRIK VON MAGGI'S NAHRUNGSMITTELN, also trading as the Maggi Co., Kempttal, near Winterthur, Canton of Zurich, Switzerland. March 20. (Associated.)

In use upon seasoning for food other than soups the mark will be varied by the substitution of the name of such goods for the word "soups".

The mark consists of the device of the bottle bearing the label shown, and registration is not to prevent any other person from using a bottle of any particular shape.

The applicants undertake not to use the cross device in red, or in white on a red ground, or in any similar colour or colours.

Registration of this trade mark shall give no right to the exclusive use of the device of a bottle.

NUGGET. — 558,089. **Canned meats, canned fish, canned fruits, canned vegetables, and dried and evaporated fruits.** SAML. HANSON AND SON, LTD., 14, Eastcheap, London, E.C. 3. April 3. (Associated.)

PREMIADO.—557,985. **All goods in Class 42, which includes substances used as food or as ingredients in food, but not including salt and not including any goods of a like kind to salt.** ALEXANDER PICKERING AND CO., LTD., Marlow House, Lloyd's Avenue, London, E.C. 3. March 20.

ROADWAYS BRAND.—554,452. **Apples.** GEOFFREY EGERTON, Roadways, Foxhole Lane, Matfield, Paddock Wood, Kent. April 10.

Registration of this trade mark shall give no right to the exclusive use of the devices of apple trees.

(Continued on next page.)

RECENT TRADE MARKS

(Continued from previous page)

SCANTIC.—558,620. **Substances used as food or as ingredients in food.** AKTIESELSKABET P. AND S. PLUM, 28, St. Annae Plads, Copenhagen, Denmark. April 3.

SEA KING.—558,058. **Cheese.** BRITISH PACKET CHEESE COMPANY, LTD., 14 to 20, Hosier Lane, West Smithfield, London, E.C. 1. April 3.

The above-mentioned goods and goods of a like kind will be struck out from the goods of Registration No. 212,715 (1054) if and before the applicants' mark is registered.

SUN-BLESSED.—556,477. **Jaffa oranges.**

HERZLIA CITRUS GROWERS' CO-OPERATIVE ASSOCIATION, LTD., 9, Maza Street, Tel-Aviv, Palestine. March 20.

SUNBRED. — 555,823. **Bread, biscuits, cakes, and cereal foods.** NOMOLAS, LTD., Salomon House, 33, St. James's Street, London, S.W. 1. March 20.

THE MATTERHORN.—557,590. **Edible oils and edible fats.**

THE SOUTHERN OIL CO., LTD., Westinghouse Road, Trafford Park, Manchester. March 27.

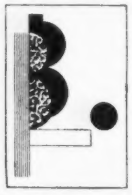
Registration of this trade mark shall give no right to the exclusive use of the words "The Matterhorn".

Registration No. 295,071 (1540) will be cancelled if and before the applicants' mark is registered.

555,021. **Bread, cakes, tea-bread, and pastry.**

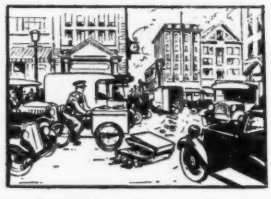
WILLIAM BEATTIE, LTD., Dennistoun Bakery, 116, Paton Street, Glasgow, E. 1. March 27.

555,285. **Biscuits and cakes.** BEATTIES



BISCUITS, LTD., Drumchapel Biscuit Works, Glasgow. March 20.

558,366. **All goods in Class 42, which includes substances used as food or as ingredients in food.**



FRANK BOLTON, The Spinney, Hunts Lane, Grappenhall, Warrington. April 3.

NEW COMPANIES

A. DARBY AND COMPANY, LIMITED. 93, Brettell Lane, Amblecote, Stourbridge. To carry on the bus. of bakers, confectioners, etc. Nom. Cap.: £2,000.

A. ROMARY AND COMPANY, LIMITED. 28-30, Church Road, Tunbridge Wells. To take over the bus. of biscuit mnfrs. cd. on by A. Romary and Co., Ltd. Nom. Cap.: £55,000.

AMOS GREGSON, LIMITED. To take over the bus. of mineral water mnfrs. cd. on as the "Tower Table Water Co." at Vicar Street Works, Dewsbury Road, Leeds. Nom. Cap.: £4,000.

BAKEHOUSE, LIMITED. To carry on the bus. of bakers, etc. Nom. Cap.: £4,000. Dirs.: G. W. Wilson, 1, Catherine Street, Winton, Lancs; Susanah B. Wilson, 1, Catherine Street, Winton, Lancs; G. W. Wilson, junr., 1, Catherine Street, Winton, Lancs.

CARNATION MILK COMPANY, LIMITED. To carry on the bus. of mnfrs., importers and exporters of and dlrs. in dairy produce, etc. Nom. Cap.: £3,000. Subs.: A. Read, 123, Wigmore Street, W. 1.; A. R. Read, 123, Wigmore Street, W. 1.

COLMAN-KEEN (NEW ZEALAND), LIMITED. To carry on the bus. of mnfrs. of and dlrs. in mustard, starch, cornflour, coffee, infant and invalid foods, etc. Nom. Cap.: £30,000. Dirs.: Sir Jeremiah Colman, Bt., address not stated; R. J. Colman, Carrow Works, Norwich; A. R. Colman, Carrow Works, Norwich; J. M. Barclay, address not stated.

G. A. PASHLEY AND COMPANY, LIMITED. To take over the bus. of a mineral water mnfr., cd. on by P. N. Willis at Havelock Street, Loughborough. Nom. Cap.: £2,500.

GREIG AND DOUGLAS, LIMITED. To carry on the bus. of biscuit and cake mnfrs., etc. Nom. Cap.: £5,000. Subs.: J. F. Seacombe, 1, Threadneedle Street, E.C. 2; E. B. Simpson, 297, Hurst Road, Bexley, Kent.

HERTFORDSHIRE CONFECTIONERY COMPANY, LIMITED. To take over the bus. of mnfg. confectioners cd. on at 55, Sotheron Road, Watford, as the "Hertfordshire Confectionery Co." and "Stracey and Co." Nom. Cap.: £1,000.

ICED CHOCOLATE COMPANY, LIMITED. 164, Blackstock Road, N. 5. To carry on the bus. of mnfrs. of and dlrs. in iced chocolate and confectionery, etc. Nom. Cap.: £300.

IVYCON, LIMITED. To carry on the bus. of mnfrs. of and dlrs. in confectionery, etc. Nom. Cap.: £100. Permt. dirs.: E. G. Richardson, Beeleigh, 72, Madeira Avenue, Shortlands, Kent; Mrs. I. D. Hughes, 26, Faraday Road, S.W. 19.

J. R. FRANKLIN, LIMITED. 33, Woodford Avenue, Ilford. To take over the bus. of a baker and confectioner cd. on by J. R. Franklin at Walthamstow and Ilford. Nom. Cap.: £2,500.

J. S. EYRE AND COMPANY, LIMITED. Castle Dyke, Launceston, Cornwall. To carry on the bus. of mineral water mnfrs. and dlrs., etc. Nom. Cap.: £1,500.

J. W. HOLLINGWORTH, LIMITED. To carry on the bus. of mnfrs. of and dlrs. in sausages and similar foods, etc. Nom. Cap.: £1,000. Dirs.: J. W. Hollingworth, 154, Langsett Avenue, Sheffield; Mrs. L. M. Hollingworth, 154, Langsett Avenue, Sheffield.

JAMES MILLER (FOOD PRODUCTS), LIMITED. To take over the bus. of a baking powder mnfr. cd. on at Cheetham, Manchester, as "James Miller". Nom. Cap. £15,000.

JULIEN LOFFET, LIMITED. 1, Exeter Road, Bournbrook, Birmingham. To carry on the bus. of mnfrs. of and dlrs. in chocolate, confectionery, etc. Nom. Cap.: £20,000.

MINSTERLEY CREAMERIES, LIMITED. 3, Nova Scotia Street, Birmingham. To carry on the bus. of mnfrs. of and dlrs. in cream, milk, butter, cheese, margarine, etc. Nom. Cap.: £20,000.

PINNOCK BROS., LIMITED. Peek House, 20, Eastcheap, E.C. To carry on the bus. of pickle mnfrs. and dlrs., etc. Nom. Cap.: £1,000.

S. BRADFORD AND SONS, LIMITED. To acquire the goodwill of certain of the assets of the bus. of bakers, confectioners, etc., cd. on at Birmingham as "S. Bradford and Sons". Nom. Cap.: £50,000.

SENIORS (CHESTER), LIMITED. 18, Frodsham Street, Chester. To carry on the bus. of bakers, etc. Nom. Cap.: £500.

STANDARD BAKERY COMPANY, LIMITED. 7 to 15, Swan Street, Southwark, S.E. 1. To carry on the bus. of bakers, etc. Nom. Cap.: £2,500.

STRAWS (HOVE 1935), LIMITED. 35, Waterloo Street, Hove. To acquire a certain recipe for the manufacture of cheese straws, etc. Nom. Cap.: £450.

TRESFARIN COMPANY, LIMITED. To carry on the bus. of mnfrs. of and dlrs. in flour, yeast and other ingredients used by bakers or confectioners, etc. Nom. Cap.: £100. Subs.: E. J. Evershed, Thanet House, 231, Strand, W.C. 2; Violet M. Evelyn, Thanet House, 231, Strand, W.C. 2.

UNION WINE COMPANY, LIMITED. Charing Cross House, 29a, Charing Cross Road, W.C. 2. To carry on the bus. of mnfrs. and distillers of wine, spirits, etc. Nom. Cap.: £100.

The above-mentioned particulars of new companies recently registered have been extracted from the daily register of Messrs. Jordan and Sons, Ltd., company registration agents, Chancery Lane, W.C. 2.